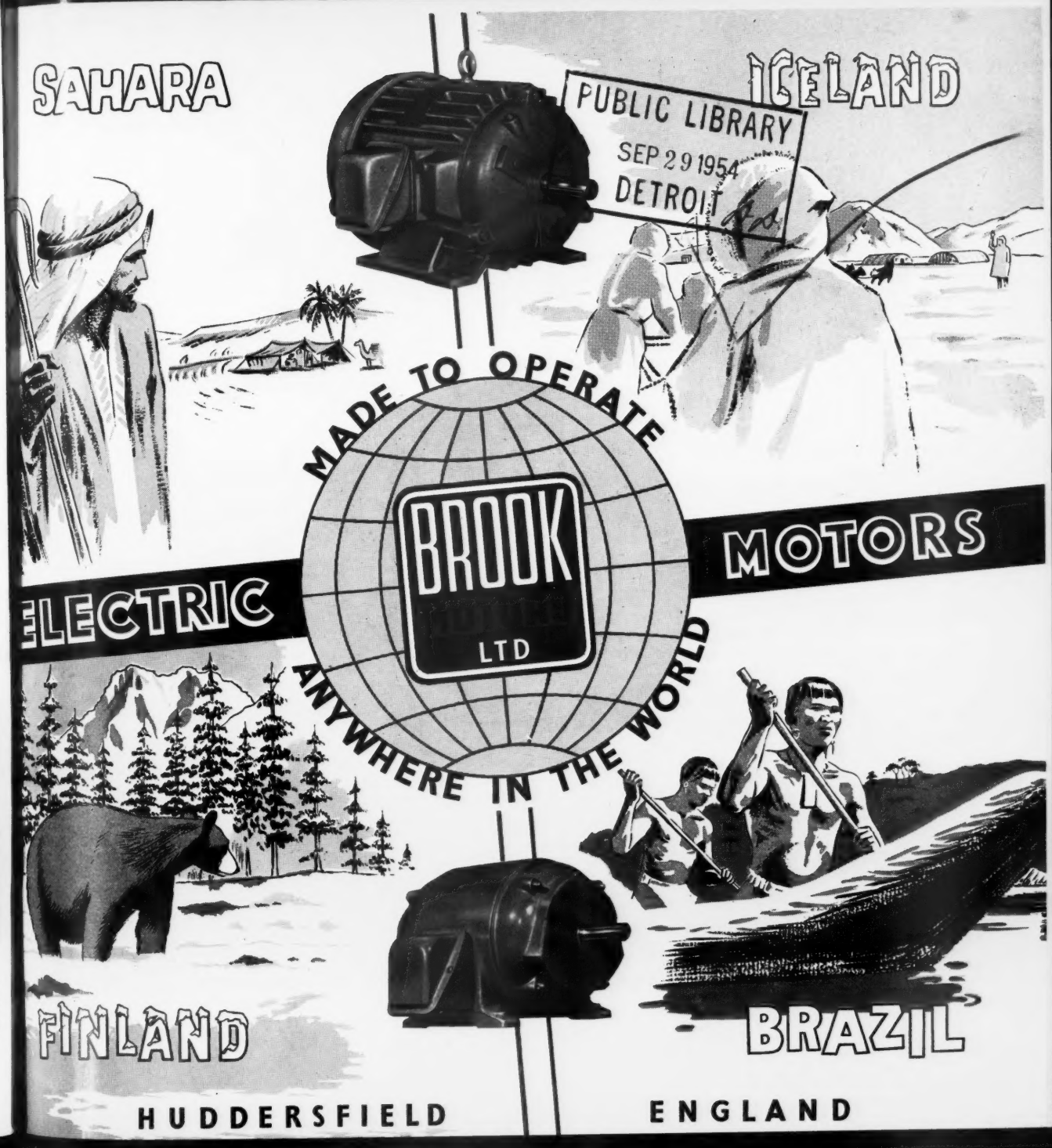
ELECTRICAL REVIEW



Quicker HEATING...

Quicker SELLING

THE NEW B·N·E C.90 ELECTRIC COOKER

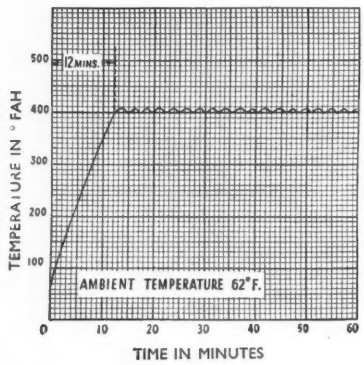
WITH THE AMAZING SPEEDHEAT OVEN!

The outstanding performance of the "Speedheat" Oven in the B.N.E. C.90 Electric Cooker—the newcomer to the B.N.E. range—will make an instant appeal to the discerning housewife.

Here is a big "easy-to-clean" oven with a new element design which, when coupled with the highly reflective pearl grey vitreous enamel and scientifically controlled air circulation, provides remarkably quick heating with superb cooking qualities.

The pre-heating time is only half that of many standard cookers. Every housewife will realise that this spells greater convenience and considerable saving of time and current.

The graph alongside shows that a temperature of 400°F is reached from an ambient temperature of 62° in **only 12 minutes.**

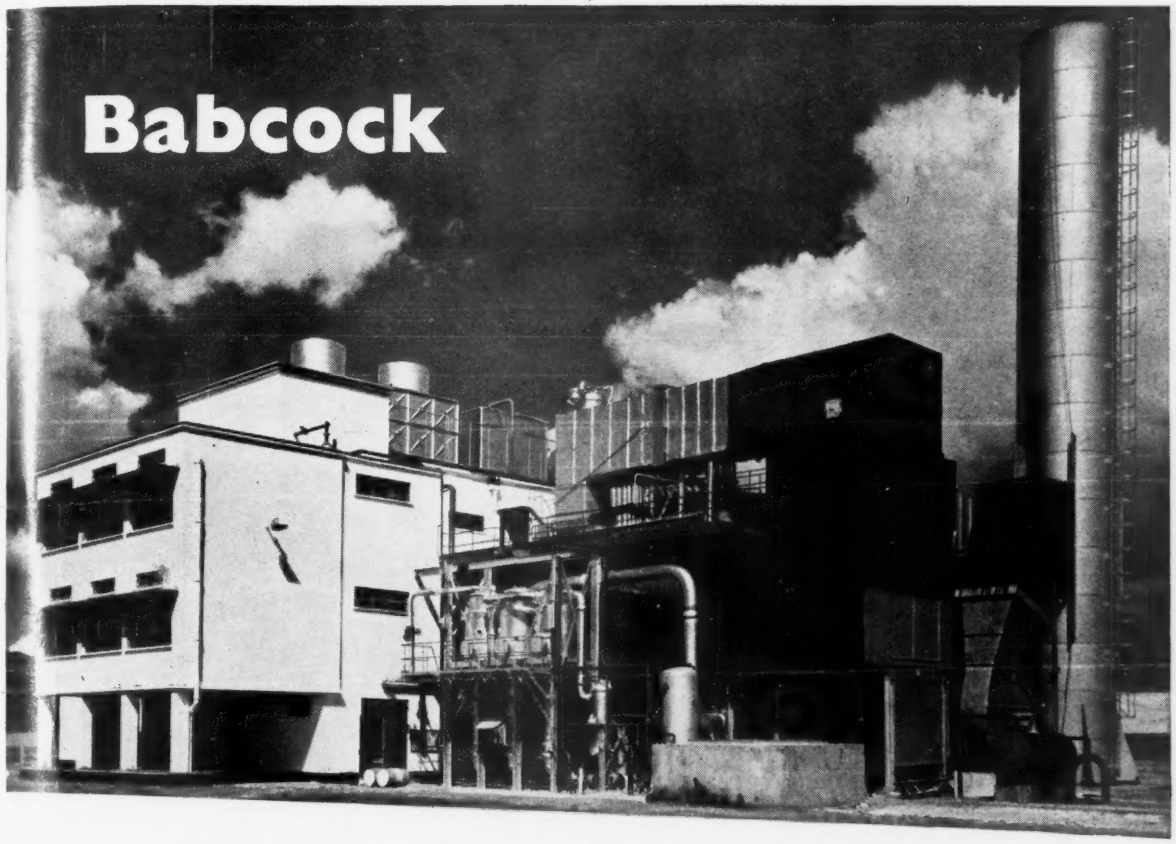


Yes, this new "Luxury" C.90 will be a quick seller—particularly when the purchaser knows that an exclusive Pyrex heat-resisting glass casserole/grill pan, a heated drawer, and an 8" radiant plate with simmer control are all included for the moderate price of £48.

BRITISH NATIONAL ELECTRICS LTD.

The Domestic Appliance Section of JOHNSON & PHILLIPS LTD.

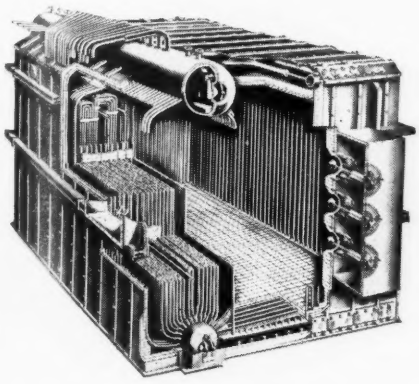
NEWARTHILL MOTHERWELL SCOTLAND



"outdoor" boiler installations

Above: *'Outdoor' boiler installation comprising a 130,000 lb./hr. oil-fired Babcock Integral Furnace boiler, at Hunts Bay power station, Jamaica. Consulting Engineers: Ewbank & Partners.*

Below: *Sectional view of an oil-fired Babcock Integral Furnace boiler.*



An interesting development in the design of steam-raising installations for industrial service and also for some electric power stations, particularly overseas, is the use of 'outdoor' boiler installations in which only the firing floor and control points may be under cover and no boiler house structure is involved.

The Babcock Integral Furnace boiler*, compact, self-contained, flexible in operation, with quick-steaming characteristics and high availability, has proved ideal for such applications. It is available in capacities from 40,000 to 250,000 lb. steam/hr., for steam conditions up to 900 lb./sq. in. and 900°F., with oil, gas or coal firing, singly or in combination.

Babcock & Wilcox Ltd. design, manufacture and erect complete installations of this type including steel chimneys, pipework and all auxiliary equipment.

* *Ask for Publication 1525*

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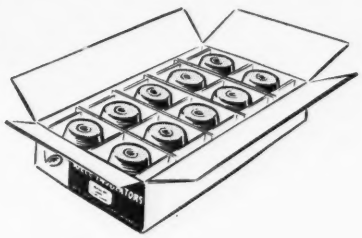

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Made in "Kite" Brand Tufnol for use in temperatures of up to 212°F—tensile breaking stress approx. 9,000 lb., 3" diameter base. Per carton of 10—£5.0.0.

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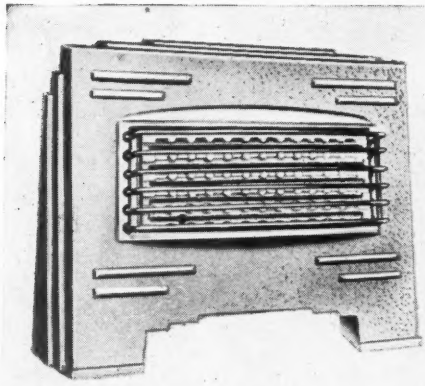

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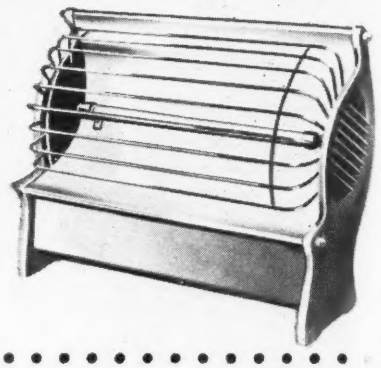

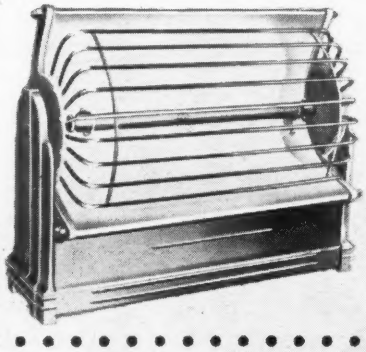

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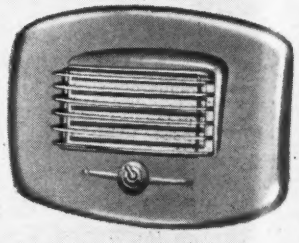

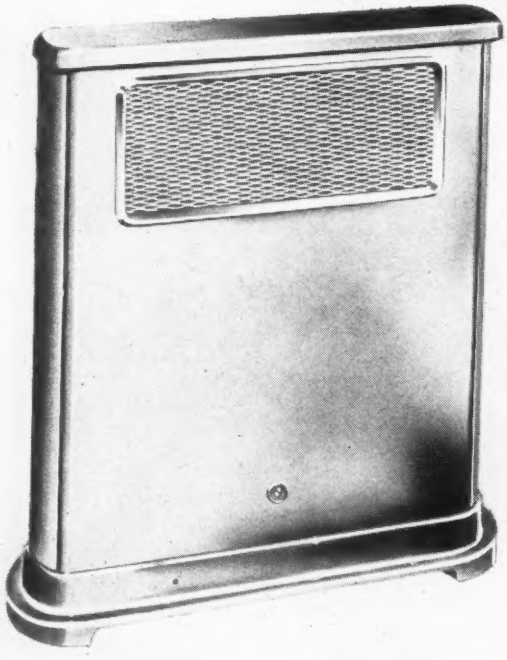

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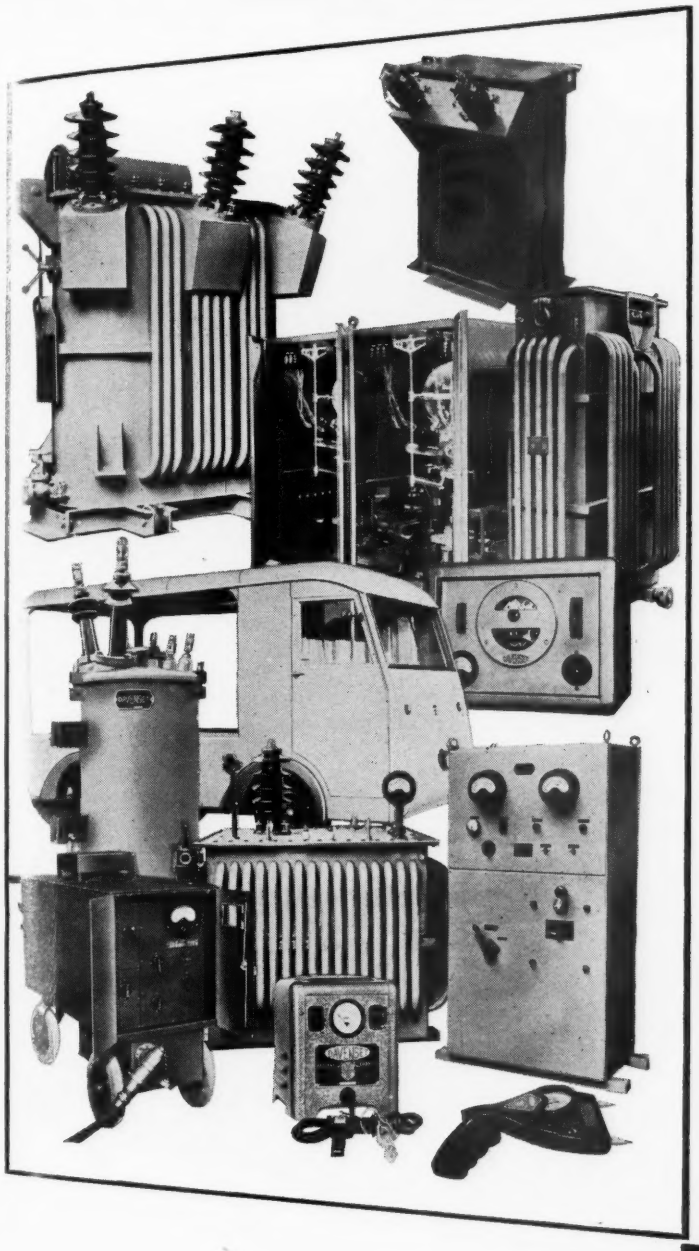

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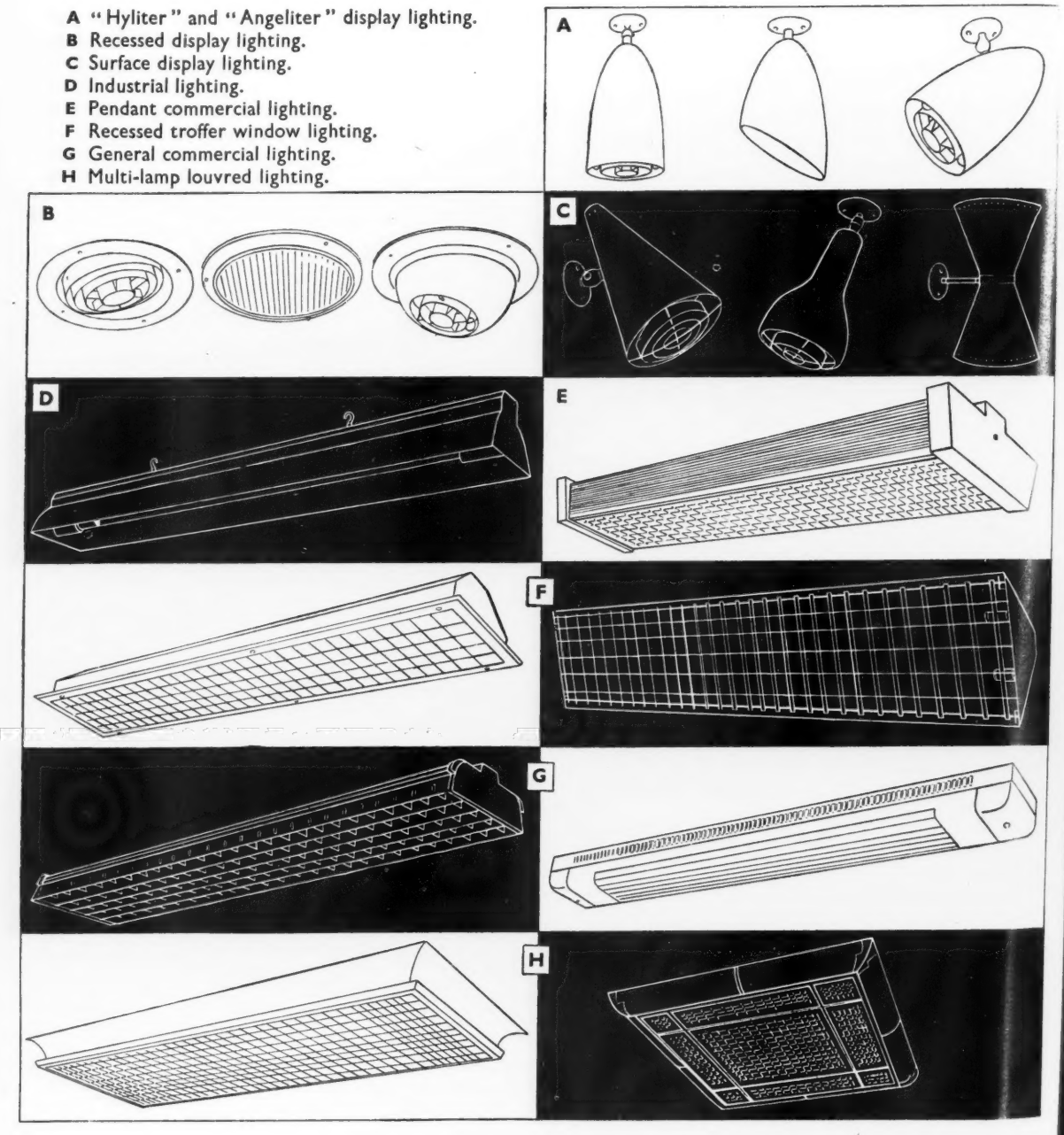

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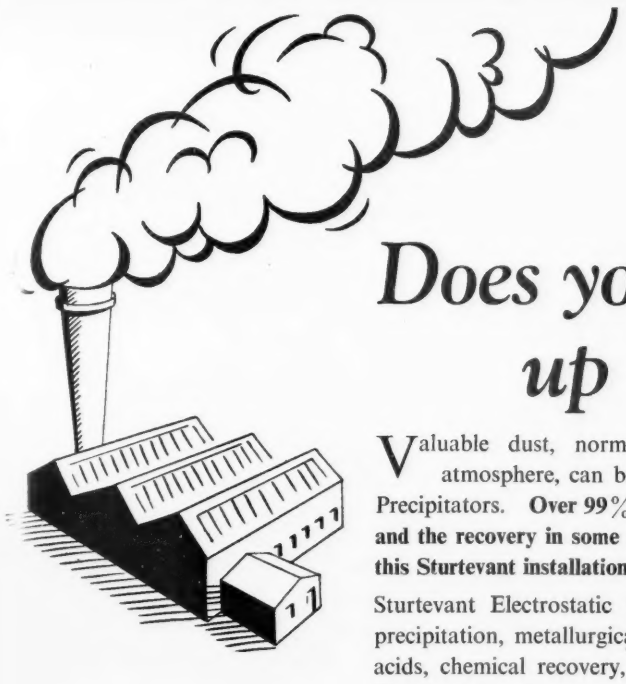

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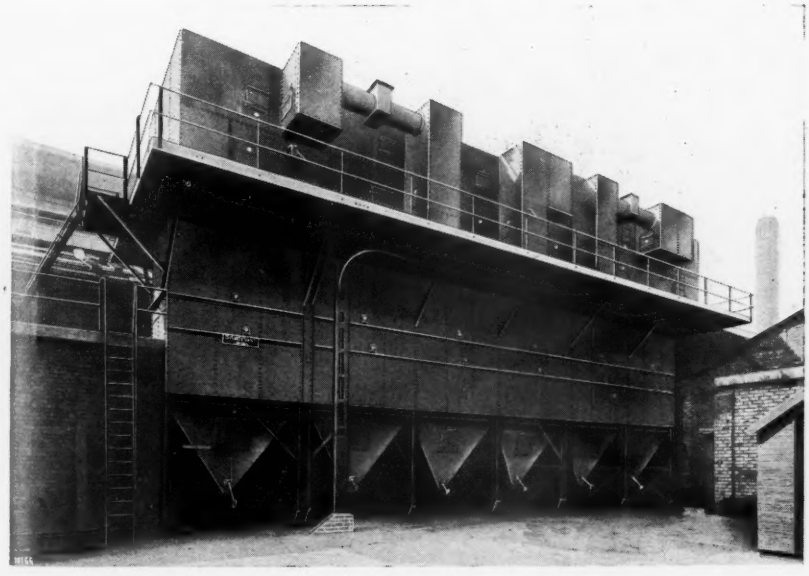
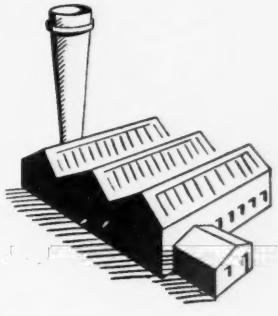


The many outstanding features in design and construction of Sturtevant Electrostatic Precipitators which contribute to their reliability and high efficiency are given in detail in our publication U.7007.



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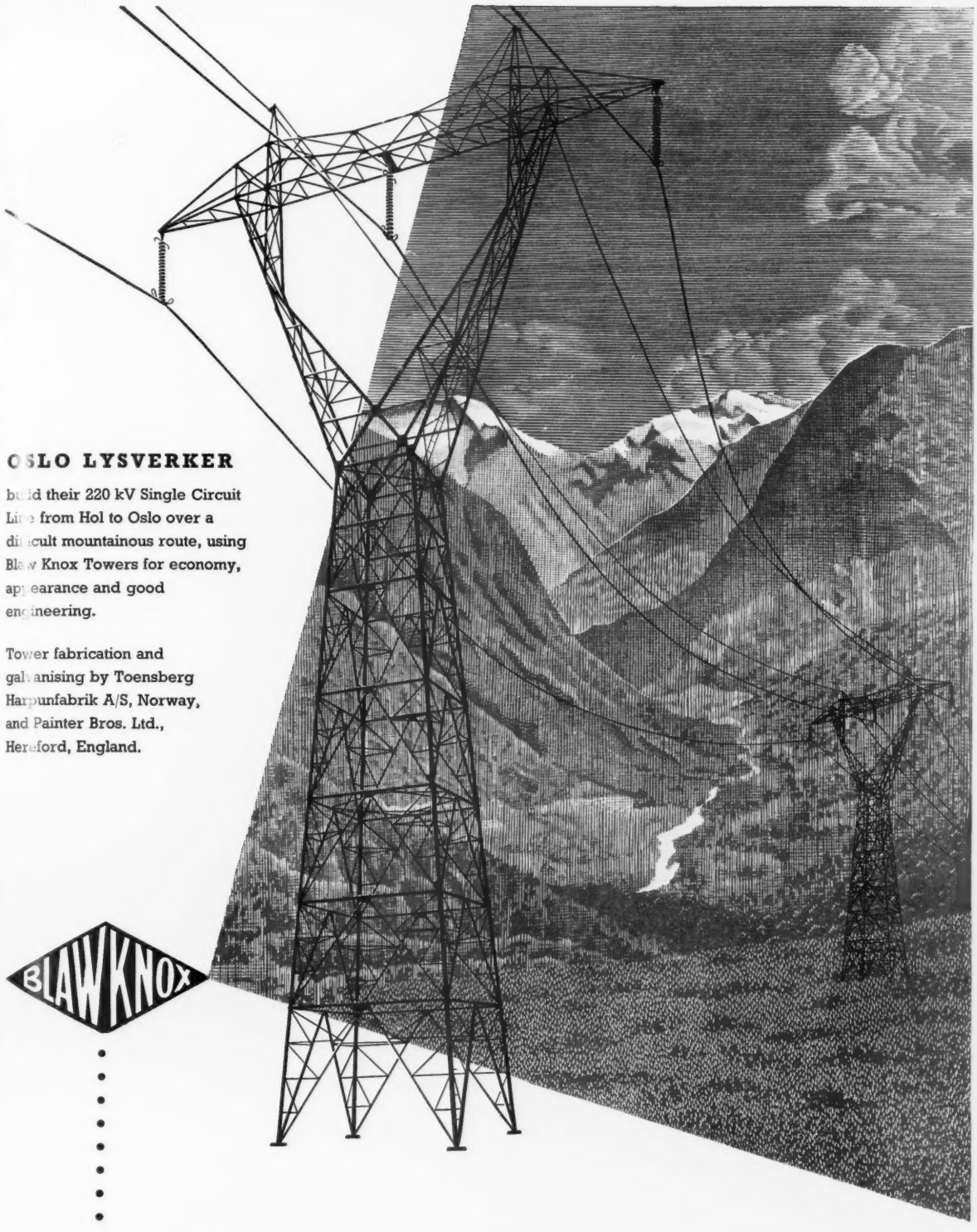

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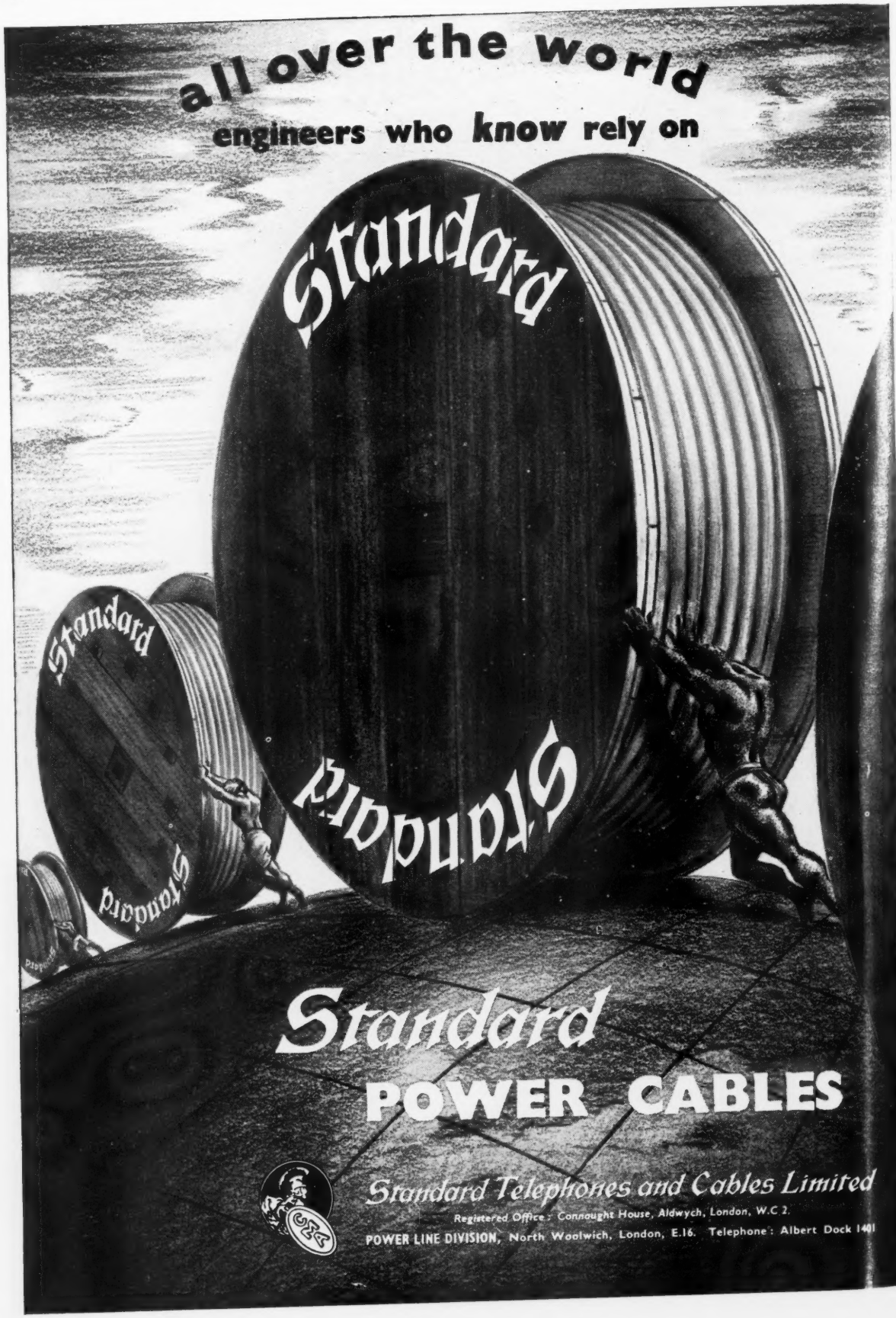
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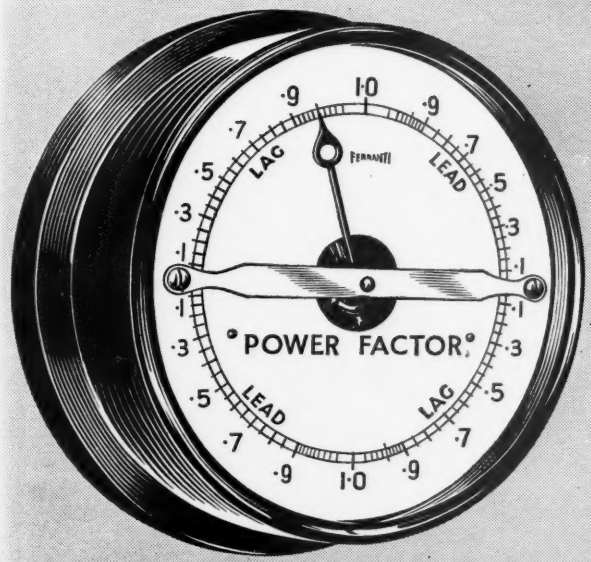
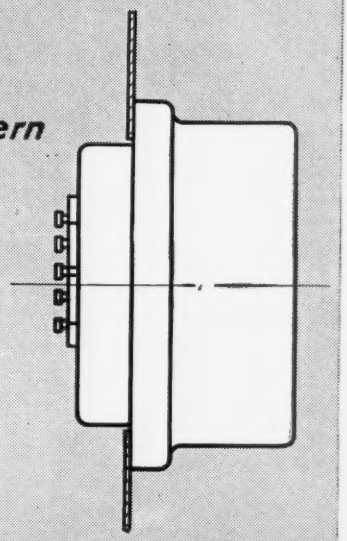


Round Pattern



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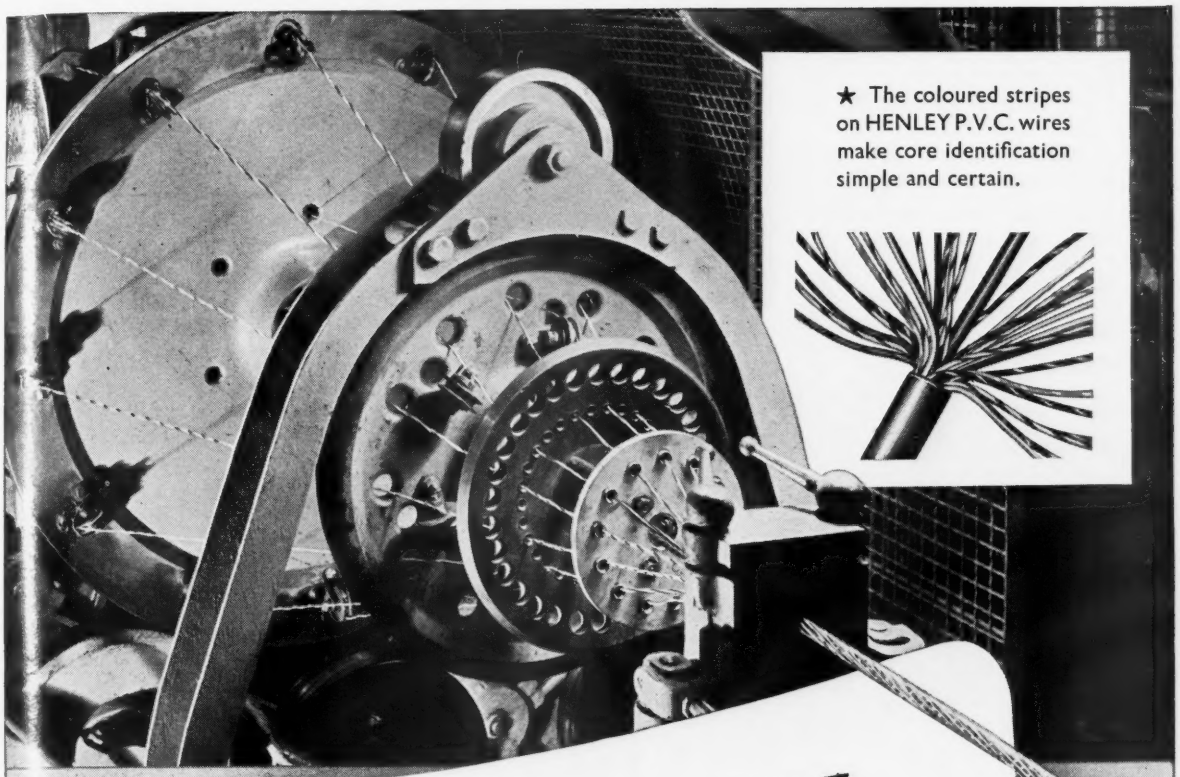

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5,000 kW (6,250 kVA) Steam Turbine driven Alternator Set by B.T.H. for 6,600/3/50, 6,250 kVA, 545 amps., 0·8 p.f. Suitable for pressure 215 lb. sq. in., 200° F., superheat total temp. 588° F., exhausting to vacuum. 28in. estimated steam consumption at load of 5,000 kW under these conditions is quoted by makers as 12·7 lbs. per kW hr. when new. Multi Jet Condenser by Hick Hargreaves with motor driven comb. water and extraction pump.

1,000 kW Condensing Turbo Alternator Set by BELLISS & MORCOM/L.D.M., giving output at 3,300/3/50, speed 3,000 r.p.m. Steam Turbine designed for use with steam at 150 lb., but makers advise suitable for pressures up to 200 lb. giving output when exhausting to vacuum 28 in. complete with Surface Condenser by BELLISS & MORCOM, the latter complete with condensate and circulating water pumps driven in tandem by 500 volt D.C. motor.

600 kW G. & J. WEIR/E.E.C. Geared Turbo Alternator Set, 150/190 lbs. pressure, 15 lbs. back pressure; alternatively 400 kW 100 lbs. pressure, 15 lbs. back pressure. Alternator 400/440/3/50.

665 kVA (500 kW) Steam driven Alternator Set by BELLISS & MORCOM/SIEMENS, for 5,000/3/50, 77 amps. Steam pressure 150/155 lb. Speed 333 r.p.m.

500 kW W. H. ALLEN/MATHER & PLATT Geared Turbo Alternator Set, 240 lbs. pressure, 100 lbs. back pressure; gearbox ratio 8,000/1,500 r.p.m. Alternator 400/3/50.

350 kW W. H. ALLEN/L.D.M. Geared Turbo Alternator Set, 180 lbs. pressure, 575° F.; pass out 1,300 lbs. per hour at 25 lbs. pressure; remainder exhausting to condenser. Alternator 400/440/3/50, 4-wire.

Two 300 kW (400 kVA) ALLEN/HARLAND, Turbo Alternator Sets for 400/3/50. Steam pressure 275 lb. sq. in., against 48 lb. back pressure, superheated 535° F., with 25 per cent. overload for 2 hours. Speed 8,000/1,000 r.p.m. through Reduction Gear.

250 kVA Steam-driven Alternator Set by BELLISS & MORCOM/HARLAND, for 400/3/50, 360 amps. 0·8 p.f. Steam pressure 140 lb., 12 lb. back pressure.

250 kW Geared Turbo Generator Set by BELLISS & MORCOM/CROMPTON PARKINSON, or 207/230 volts D.C. Speed 1,000 r.p.m. through reduction gear. Multi stage Turbine designed for steam at 290 lb., 550° F. superheat plus 25 per cent. overload for 2 hours when running at 6,000 r.p.m.

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150 kVA Steam-driven Alternator Set by BROWETT LINDLEY/INTERNATIONALE de ELECTRICITE, for 400/3/50, speed 375 r.p.m. Steam pressure 120/140 lb. Superheat 100° F., exhausting to atmosphere.

120 kW Steam-driven Alternator Set by BROWETT LINDLEY/G.E.C., for 380/400/3/50. Speed 375 r.p.m. Steam pressure 140/160 lb., 100° F. superheat, exhausting to vacuum or atmosphere.

75 kW Steam-driven Generating Set by BELLISS & MORCOM/E.C.C., for 110 volts. D.C. Will develop 115 h.p. at 500 r.p.m. when supplied with steam at 150 lb. sq. in. against 10 lb. back pressure.

75 kVA (60 kW) Steam-driven Alternator Set by BROWETT LINDLEY/L.D.M., for 440/3/50. Speed 500 r.p.m. Makers advise outputs 90 lb. W.P. at 120 h.p., 100 lb., at 138 h.p., 120 lb. at 175 h.p. all with 5 lb. back pressure. Engine originally designed to develop 60 kW with steam at 60 lb. W.P.

60 kW Steam-driven Generating Set by W. H. ALLEN, for 225/230 volts. D.C., speed 500 r.p.m. Steam pressure 170 lb.

38 kW Steam-driven Generating Set by BELLISS & MORCOM/E.C.C. for 440 volts D.C., 3 wire 86·5 amps. Steam pressure 140 lb. sq. in. condensing. With modifications will give 5 lb. back pressure.

31·25 kVA (25 kW) Steam-driven Alternator Set by BELLISS & MORCOM/L.D.M., for 400/3/50. Speed 750 r.p.m. Makers advise will develop 40 h.p. with steam at 180 lb. W.P., superheated to total temp. 600° F. exhausting to atmosphere. With superheated steam and valve modifications would exhaust against 20/25 lb. back pressure.

15·75 kW Steam Engine-driven Generating Set by HINDLEY/E.C.C., for 225 volts D.C., 70 amps., speed 650 r.p.m. Steam pressure 100 lb. sq. in.

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ER/54/PG396

Nuts in May

How firmly a wrong or old-fashioned idea sticks!

Children still sing about "gathering nuts in May"—when there are certainly none to be gathered—and nobody bothers to correct them though we all know it should be "knots of May", or bunches of May flowers.

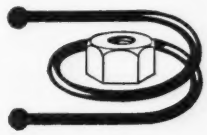
Just as absurd in industry is the method of hardening metal nuts by a flame when this process can be done so much better by induction heating.

It makes the old-fashioned method look as ridiculous—well, as ridiculous as trying to go "gathering nuts in May".

Are you using out-of-date heating methods? Write today to The ENGLISH ELECTRIC Company, Industrial Electronics Department "D." A letter may save you a lot of money.

With automatic timing, automatic feed and *controlled* quantities of heat, each hardened nut comes out the identical twin of its predecessor and at a high production rate! Four thousand an hour on a job like this is quite normal, requiring just one unskilled girl to stand and watch.

An 'ENGLISH ELECTRIC' R.F. Heater can release as many as six skilled operatives for other work.



'ENGLISH ELECTRIC'

induction heaters

See also our Industrial Actuators advertisement in this issue.

THE ENGLISH ELECTRIC COMPANY LIMITED, QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

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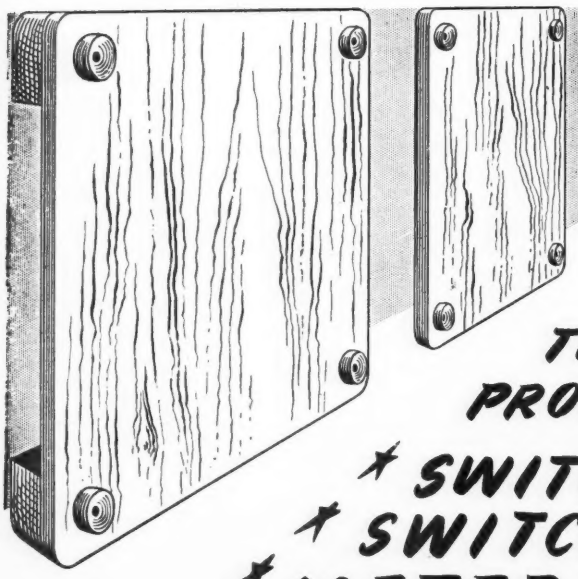

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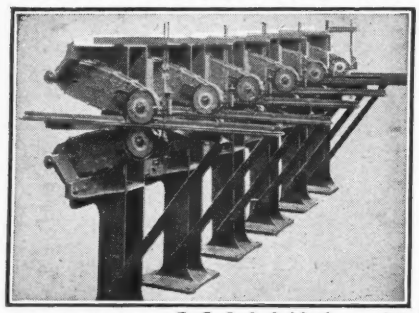

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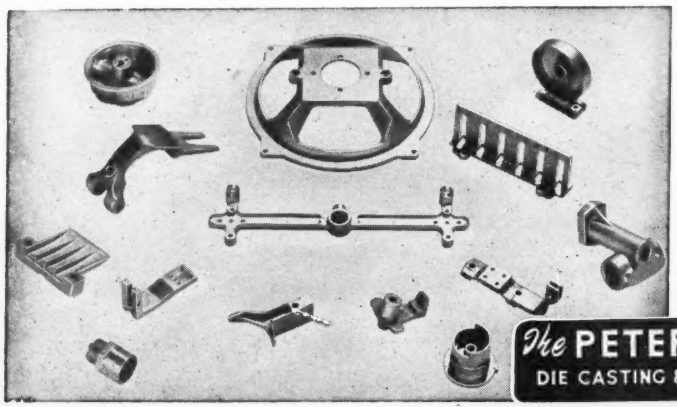

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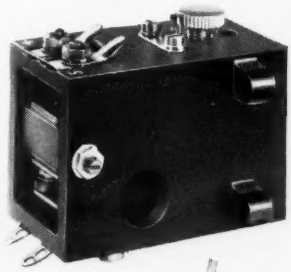
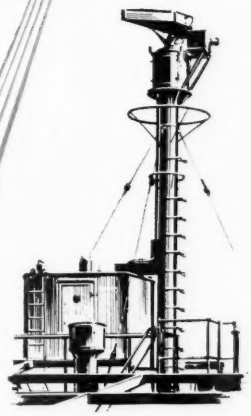


B.T.H. Transceiver Unit with doors open.



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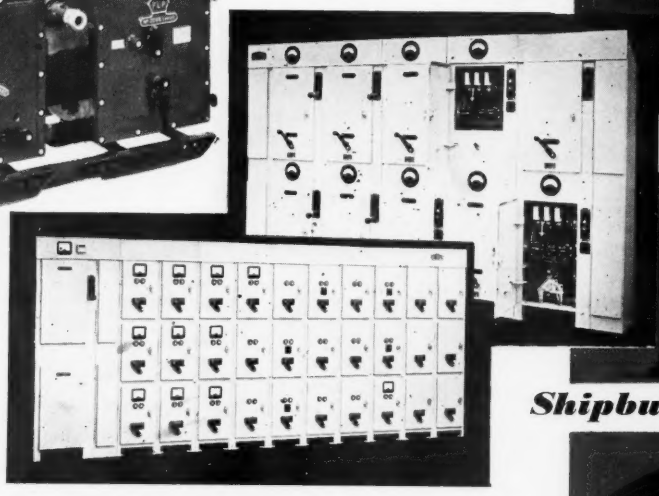

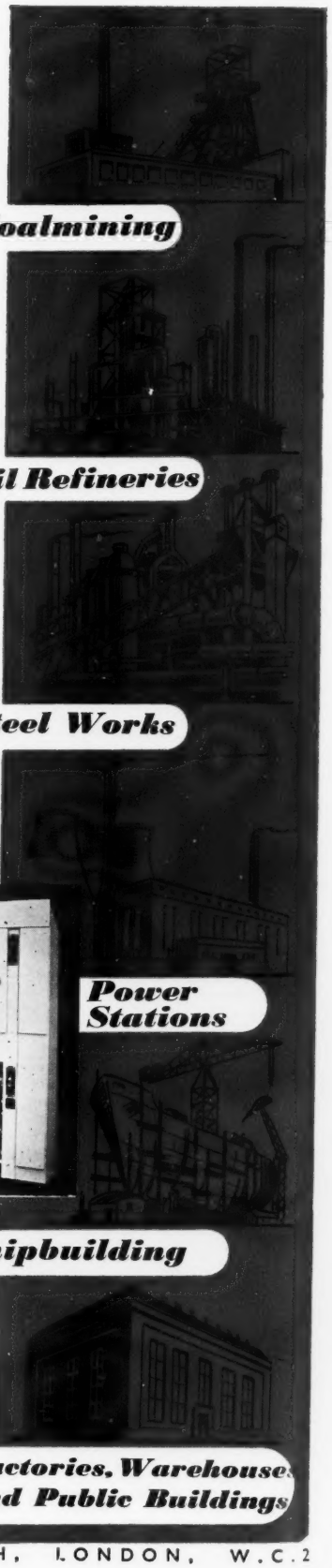

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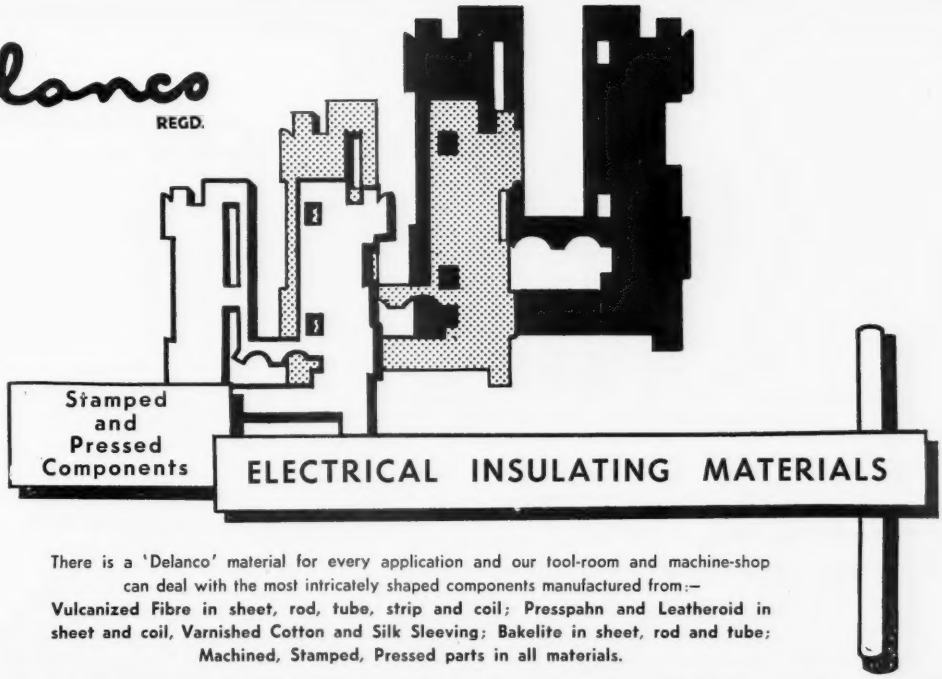

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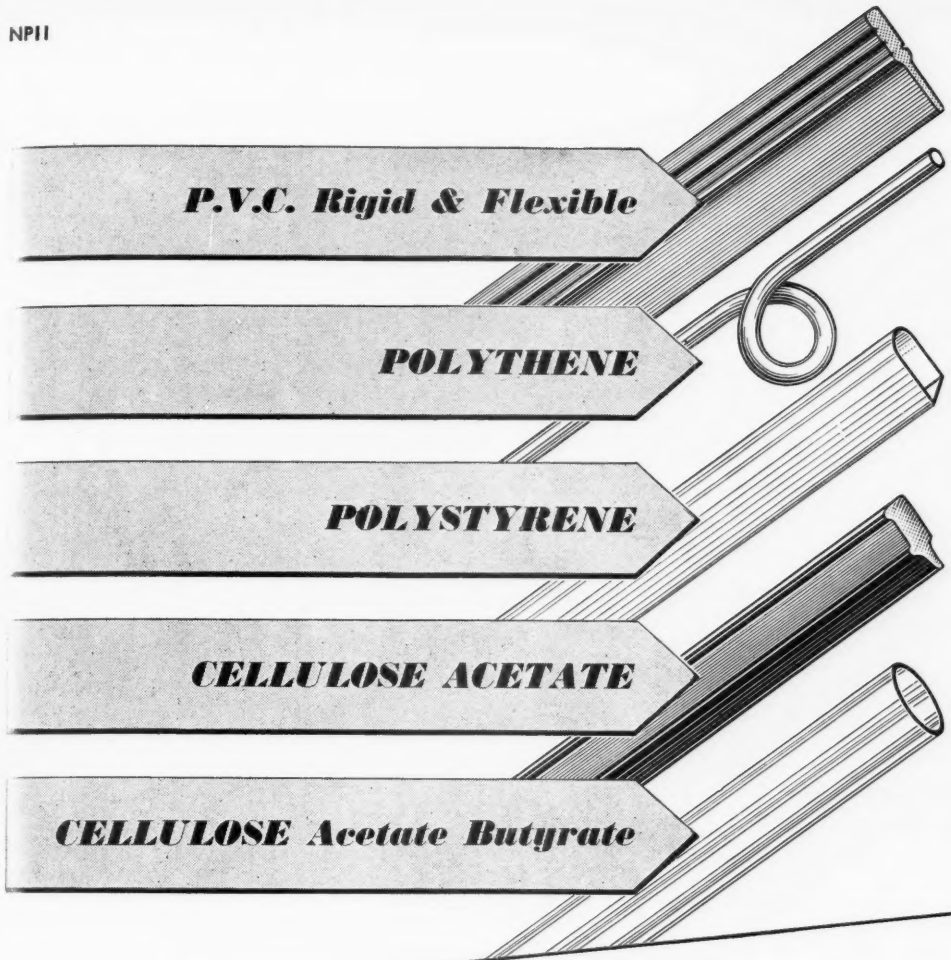

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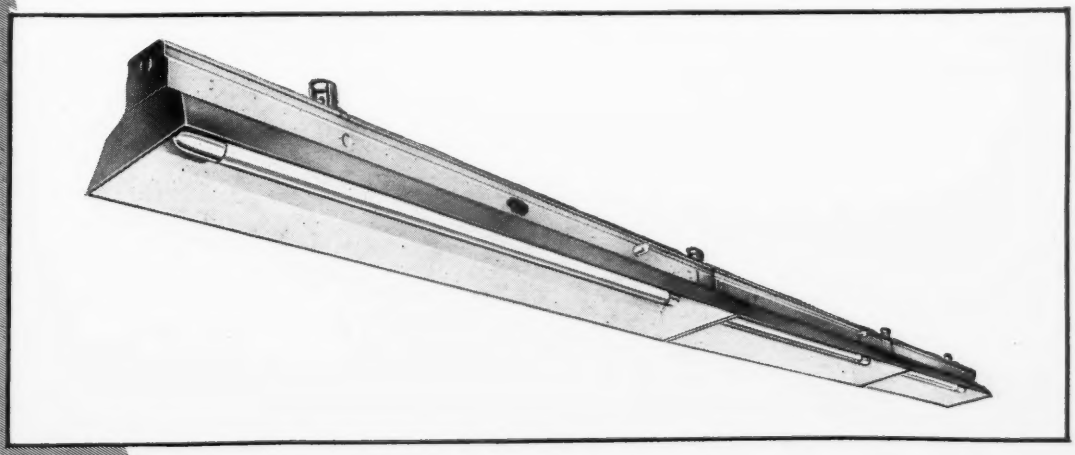

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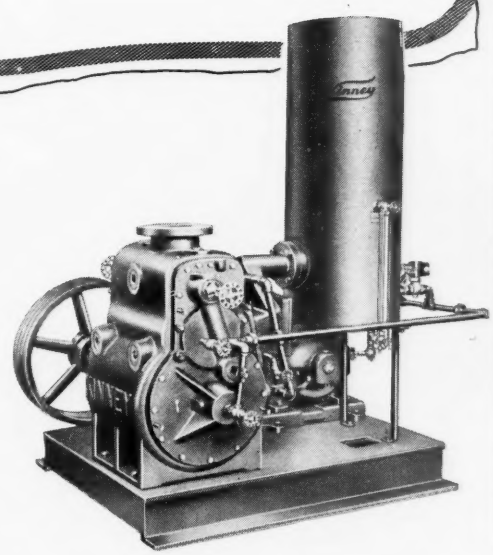

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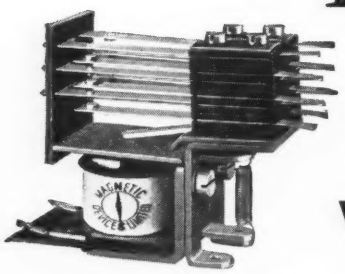

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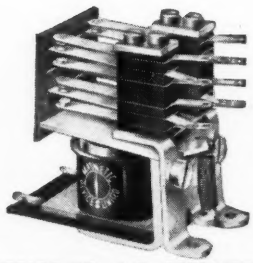

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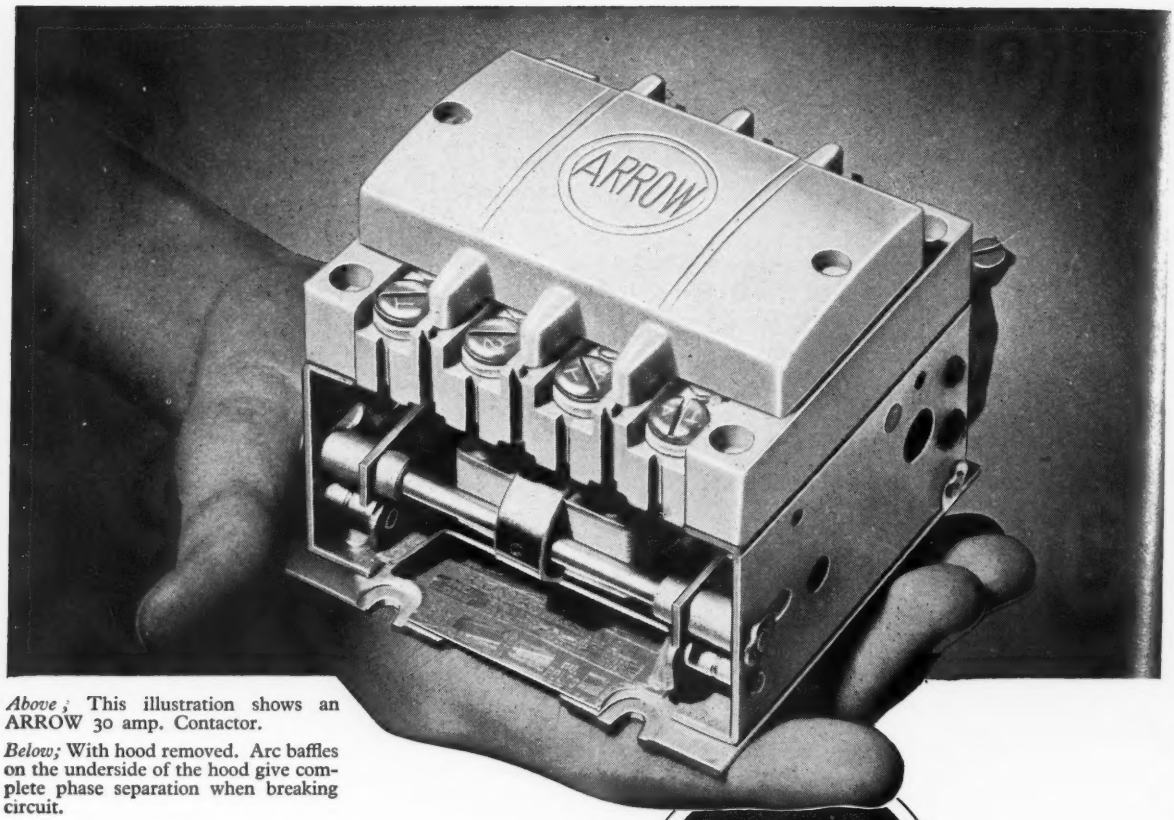
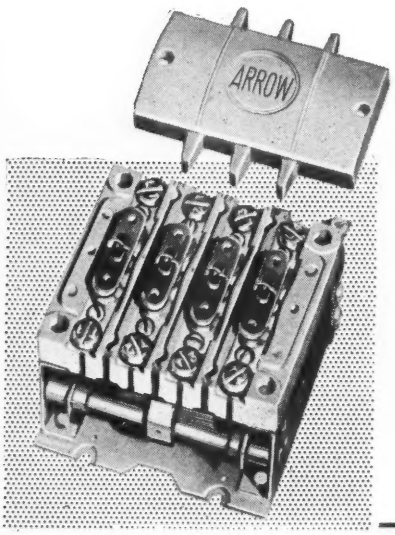


Above; This illustration shows an ARROW 30 amp. Contactor.

Below; With hood removed. Arc baffles on the underside of the hood give complete phase separation when breaking circuit.



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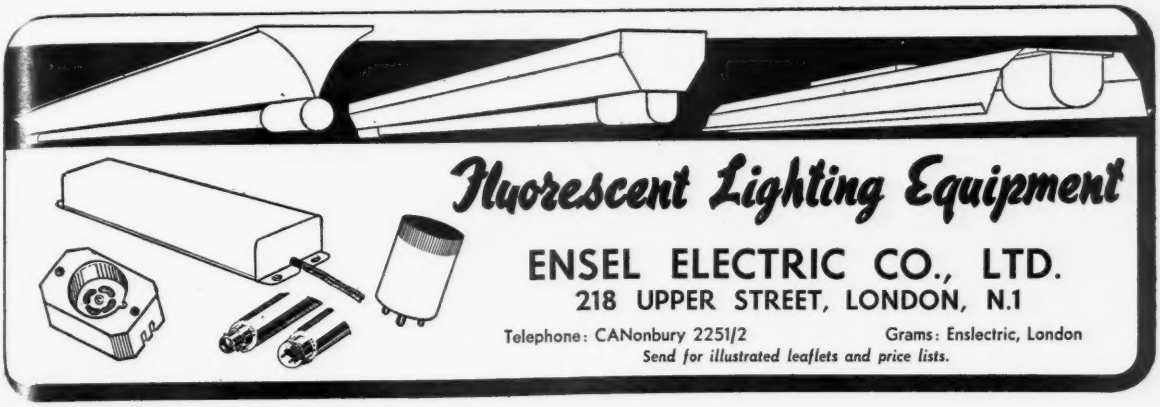

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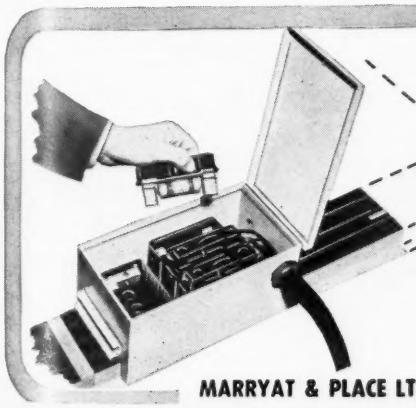

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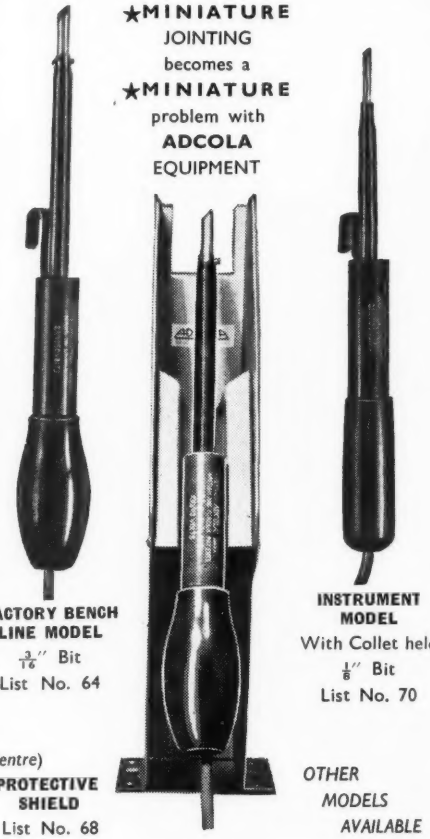

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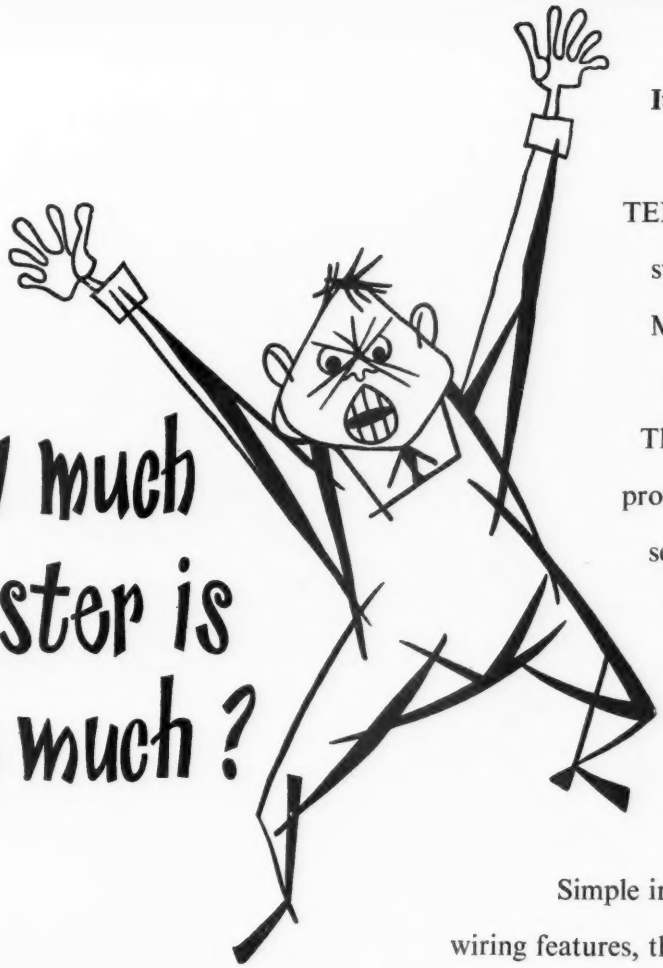

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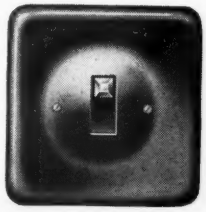

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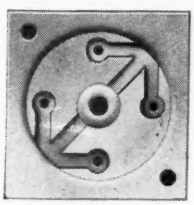

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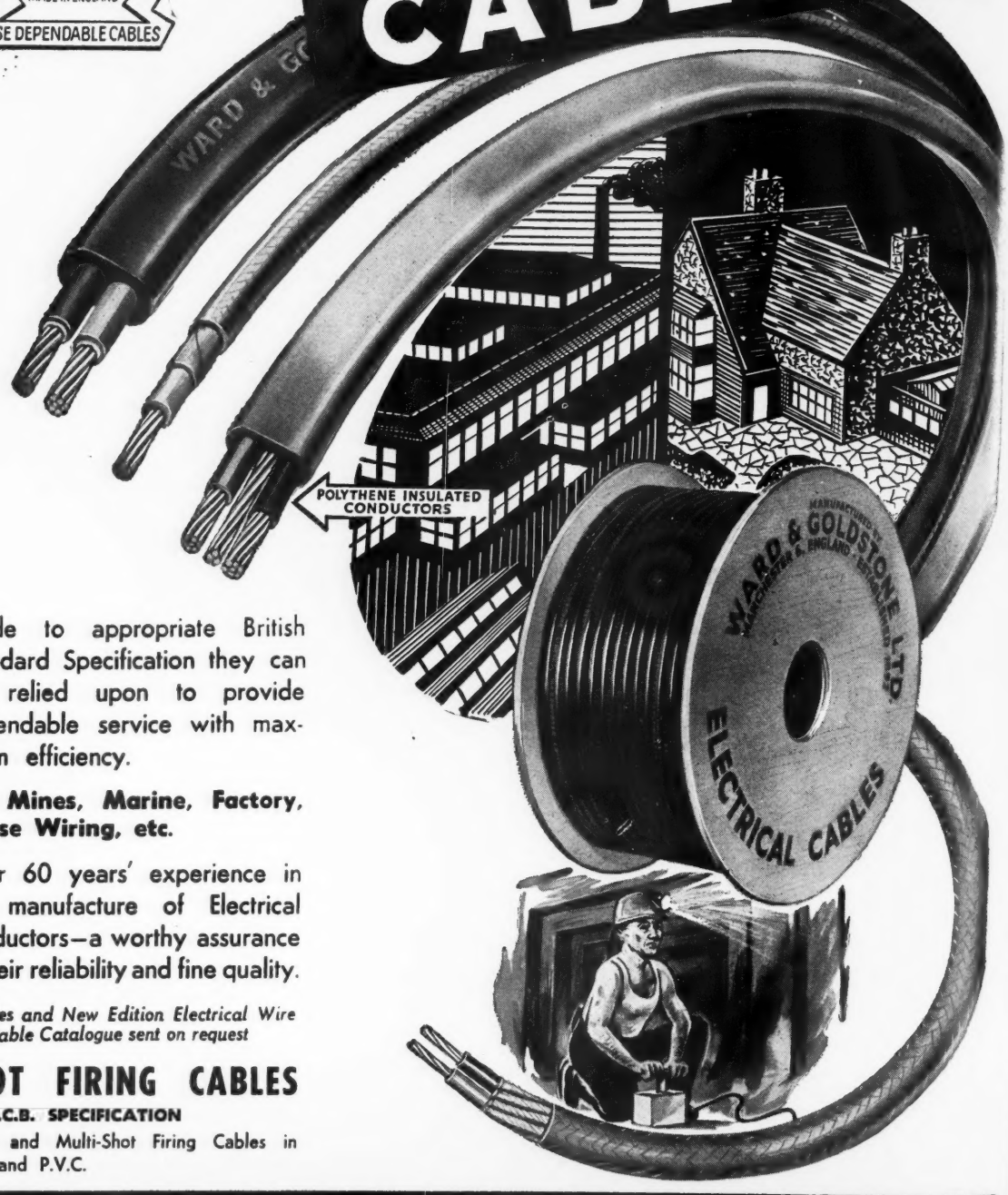
T.R.S · V.I.R. and P.V.C. Sheathed
CABLES



Made to appropriate British Standard Specification they can be relied upon to provide dependable service with maximum efficiency.

For Mines, Marine, Factory, House Wiring, etc.

Over 60 years' experience in the manufacture of Electrical Conductors—a worthy assurance of their reliability and fine quality.

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TO N.C.B. SPECIFICATION
Single and Multi-Shot Firing Cables in V.I.R. and P.V.C.

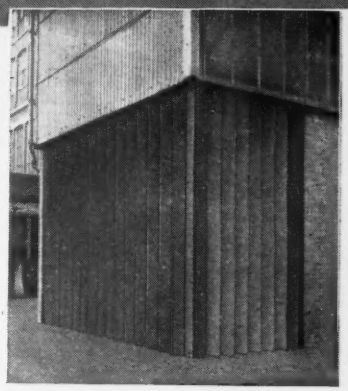
WARD & GOLDSTONE LTD.
SALFORD 6 ENGLAND

C1229

A problem with 2 solutions!

POWER OPERATED SHUTTER DOORS at right angles solve difficult access problem

This installation at a Lancashire Mill loading bay illustrates the adaptability of Bolton Patent Shutter Doors. By meeting at right angles, these two doors make the most of the limited space available, giving maximum accessibility. In addition these doors are power operated with remote control from a point inside the main building.



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DOORS & GATES

WRITE FOR THIS CATALOGUE NOW!
Our full range of doors and gates, with manual, power or photo-electric cell operation to meet individual requirements, is described in our 104-page Catalogue EL'54.

BOLTON GATE CO. LTD., BOLTON, LANCS. London Office: 248 Perth Road, ILFORD, ESSEX

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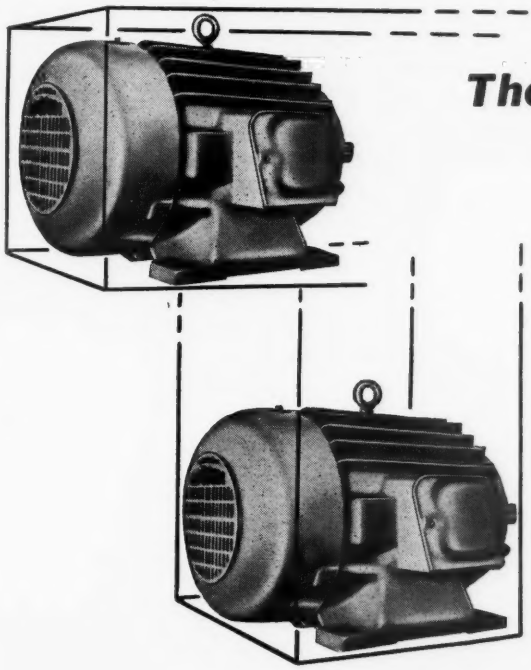

The fitting answer . . .

Users of motors for driving machinery will probably find the answer to their standardised motor needs in the Brush 'B' range of squirrel cage, totally enclosed, fan cooled types. They are built to British Standard Dimensions (B.S. 2083, 1954) which determine all basic fixing and general physical dimensions to ensure that these motors are interchangeable with other B.S.D. Motors.
Designed and built from accumulated experience gained from over 70 years of electric motor manufacture, these sturdy machines will meet arduous conditions of service.
The range of sizes available covers from 1 to 25 h.p.
WRITE TODAY FOR STOCK LIST

B.S.D. Motors by BRUSH

BRUSH ELECTRICAL ENGINEERING CO. LTD., HOPKINSON WORKS, CARDIFF, GREAT BRITAIN

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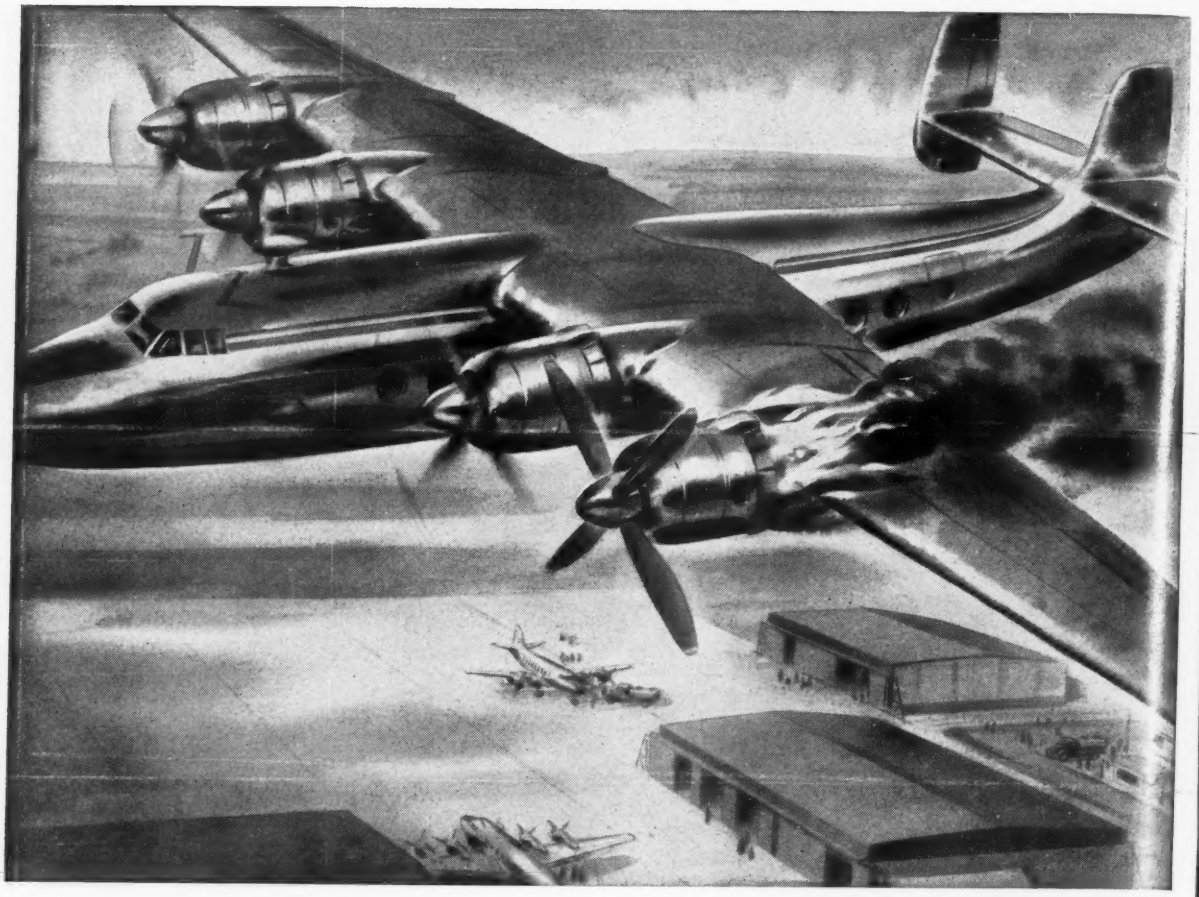

Once this would have meant almost certain disaster . . .

Today it probably means no more than an extra job for the ground staff—for modern multi-engined aircraft will fly with one or more engines shut-down . . . provided the controls to the remaining engines are intact. This is one reason why most aircraft use 'Fibreglass' insulated Pren* cables which stand up to direct exposure to flame. Other reasons — which apply to all 'Fibreglass' electrical insulation — are less weight, less space, greater heat resistance, higher safe working-temperatures, freedom from alkali with consequent resistance to moisture. All of which mean longer life and greater reliability.

**'Pren' cables incorporate one or more layers of braided glass fibre and are finished with a fire-retarding lacquer.*

wrap it in* FIBREGLASS *for safety

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DURABLE · FIRE-SAFE · ECONOMICAL · AND AVAILABLE NOW

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IN SPEED-POWER-STAMINA AND RELIABILITY

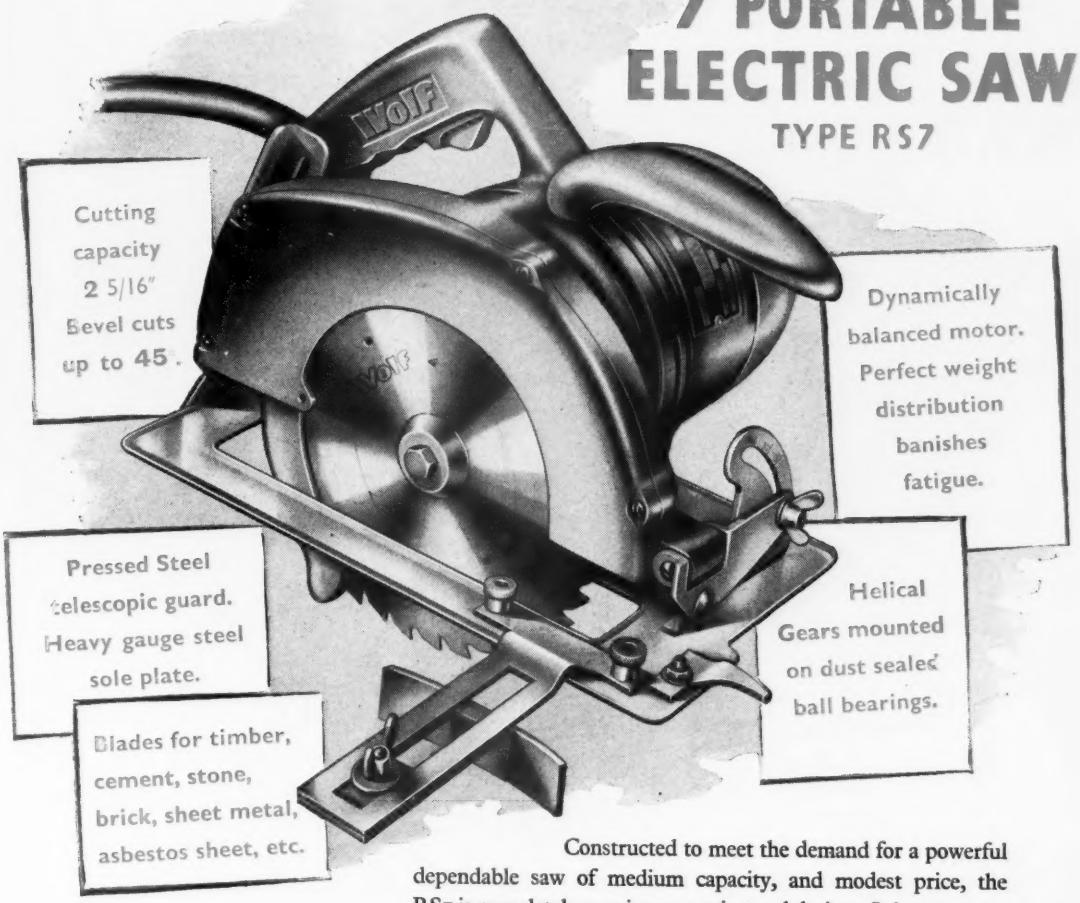
— SLASHES SAWING COSTS

NEW!

Wolf

7" PORTABLE ELECTRIC SAW

TYPE RS7


Cutting capacity 2 5/16" Bevel cuts up to 45°.
Dynamically balanced motor. Perfect weight distribution banishes fatigue.
Pressed Steel telescopic guard. Heavy gauge steel sole plate.
Helical Gears mounted on dust sealed ball bearings.
Blades for timber, cement, stone, brick, sheet metal, asbestos sheet, etc.

Constructed to meet the demand for a powerful dependable saw of medium capacity, and modest price, the RS7 is completely new in conception and design. It incorporates a new motor, specially designed by Wolf technicians, with exceptional power/torque characteristics providing highly efficient maintained cutting speed under full load. Compact, light in weight, easy to handle, with simple adjustments this superb tool offers unique opportunities for greater output at lower cost and less fatigue. *Write for full catalogue details.*

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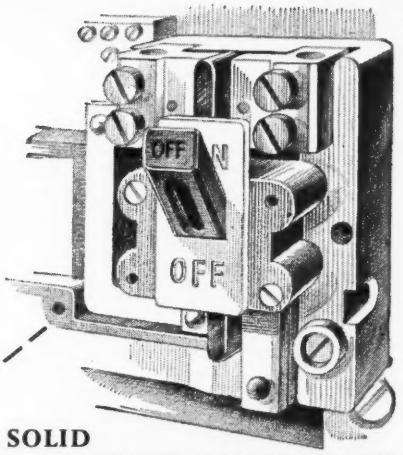
B

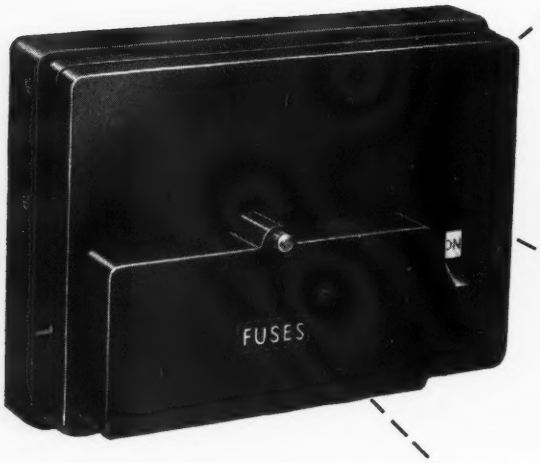
3 of the many points about Wylex Fuse Units which customers specially like...



SOLID PERMANENT CONNECTIONS

We could have used cables to link the bus bar and neutral bar to the Switch. This would have cut cost a few pence, but it would also have cut efficiency. We aim at low losses with the Wylex Unit. So we made the links solid.

The switch, too, is an example of Wylex thoroughness. It is not the standard 60 amp. Wylex switch — but one specially adapted to suit the fuse unit assembly.



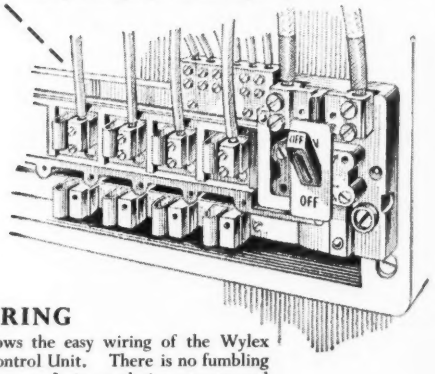
CIRCUIT IDENTIFICATION

Your Electrician writes the circuit details in pencil on the inside of the Wylex Fuse Unit Cover. This has a special surface which takes pencil writing easily and legibly. It is a Wylex patent.

WYLEX

SWITCH FUSE CONTROL UNITS

Made in 1, 2, 3, 4, 6, 8 Way. Rewirable or H.R.C. Cartridge. All-Insulated or Metalclad.



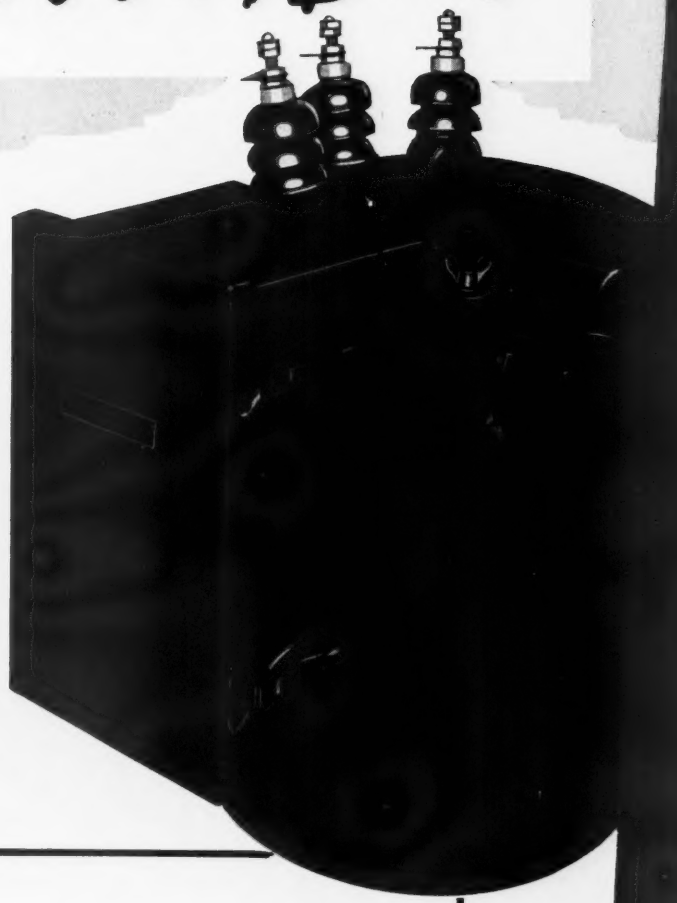
EASY WIRING

The sketch shows the easy wiring of the Wylex Switch Fuse Control Unit. There is no fumbling in awkward corners. It is a real time saver; and its neatness satisfies the most fastidious.

Write for Catalogue to:

GEORGE H. SCHOLES & CO. LTD · Wylex Works · Wythenshawe · Manchester

A NEW CONCEPTION IN LINE BOOSTERS

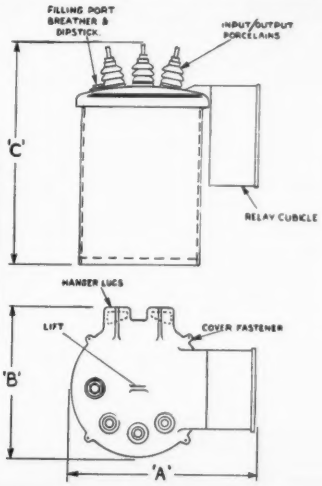


THE BRENTFORD Tail-End Booster represents a completely new conception in line boosters, making available a cheap reliable unit for rural distribution networks.

It provides the most economical means of maintaining rated voltage to the consumer, ensuring maximum efficiency and performance from lamps, motors, radio, television, electric fires, and other equipment on the system.

Designed as a single phase unit, it is suitable for single phase supply or banked in star to provide independent control of each phase of a 3-phase 4-wire system.

Approximate overall dimensions and shipping specifications



Through put kVA	DIMENSION A	B	C	Approx. Net Weight
5	18½ ins	13½ ins	23 ins	150 lbs
10	18½ ins	13½ ins	28 ins	190 lbs
15	18½ ins	13½ ins	36 ins	250 lbs
20	18½ ins	13½ ins	44 ins	310 lbs

Through put kVA	DIMENSION A	B	C	Approx. Net Weight
5	47 cm	34.4 cm	58 cm	69 Kg
10	47 cm	34.4 cm	71 cm	87 Kg
15	47 cm	34.4 cm	91 cm	114 Kg
20	47 cm	34.4 cm	112 cm	142 Kg

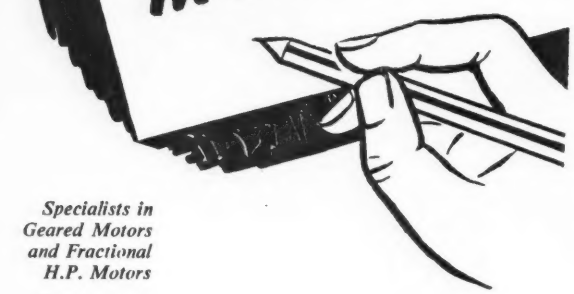
Send for fully descriptive leaflet

BRENTFORD TRANSFORMERS LTD.

Kidbrooke Park Road, London, S.E.3. Telephone: LEE Green 1006. Cables: "Breco, London"

make a note of it!...

JEARY for GEARED MOTORS



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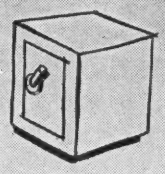
Sealed like a safe!

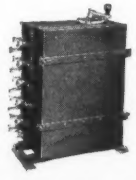


NELBEST

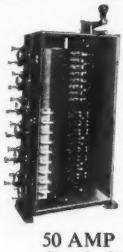
DRUM CONTROLLERS

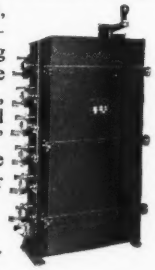
are dust and drip proof

FOR A.C. OR D.C. MOTORS



. . . For the heavier industries NELBEST Controllers are built as a Controller should be built. Compact in design for easy installation—extra robust mechanism for long life service . . . built into a heavy section fabricated structure that is dust-proof and drip-proof. These Controllers give faultless operation during frequent starting, stopping, slowing and reversing. They are made to withstand rough usage, flying dust, insidious moisture—the severest working conditions of the milling, mining, steelmaking and other 'heavier' industries have proved their efficiency.





50 AMP
Height 24¼". *Base width* 20¼"
100 AMP
Height 32⅞". *Base width* 20¼"
150 AMP
Height 43¼". *Base width* 24⅜"

Put NELBEST *in 'control'*

Full details on application to:

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MOSSEND BELLSHILL LANARKSHIRE

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The Largest Ceiling...

THIS IS BELIEVED to be the largest ceiling in Great Britain combining lighting, radiant heating, ventilation, and acoustic insulation.

The high voltage cable for the wiring of the exceptionally modern lighting system in this building, the Research and Design Departments of C. A. Parsons & Co. Ltd. at Newcastle-upon-Tyne, was supplied by Enfield Cables Limited.

Over 7,000 "Osram" Cold Cathode Tubes, automatically controlled by photo-electric cells, are installed in this building, some 12 miles . . . and another 13 miles in the adjoining factory.

Enfield are proud to be associated with such an enterprise and can offer cables of the same reliability and performance for immediate delivery throughout the country.

We will be pleased to add your name to our mailing list for details of our monthly stocks of Paper Insulated Cables and Winding Wires.

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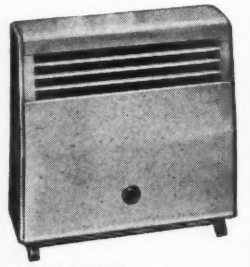
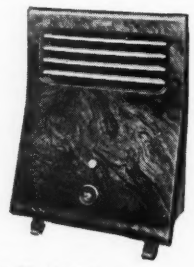
E 33

Autumn winds bring **Thermovent** *sales!*

DELIVERY FROM STOCK *NOW!*



Steel-cased SR Heaters
Handsome floor-standing type with metal case finished in light bronze enamel, fitted with luminous effect. Available in 1, 2 and 3 Kw loadings with or without Automatic Heat Control. From **£8.17.7**

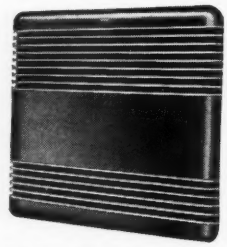


1 Kw FR Heater
Floor-standing model with walnut finish plastic front panel and warm luminous effect behind 'old gold' metal grilles. With or without Automatic Heat Control. **From £9.11.3**

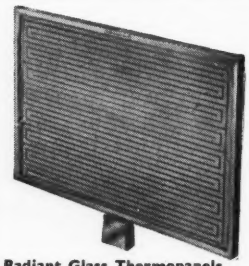
2 Kw FR Heater
Larger version of the attractively styled floor-standing heater. Available with or without Automatic Heat Control. From **£14.6.10**

Thermotubes
Tubular heaters in lengths from 2 ft. to 12 ft. giving a flexibility of installation to meet the most difficult heating problems. From **£1.0.6**
Waterproof types also available.

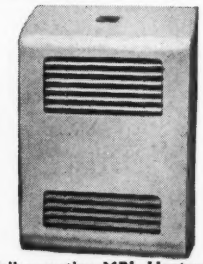
1 Kw Inset Heater
Inset type heater for building into walls and furniture. Front panels in walnut plastic, with grilles coloured 'old gold.' With or without Automatic Heat Control. From **£10.4.11**



2 Kw Inset Heater
Attractively styled 2 Kw version of the Inset type for large area heating. Available with or without Automatic Heat Control. From **£14.13.8**



Radiant Glass Thermopanels
Wall-mounted heaters for rapid local heating. 750w and 1 Kw loadings in two types: type RG for industrial applications, type RGF with wall frame for use where appearance is important. From **£8.17.7**



Wall-mounting MRL Heaters
Robustly constructed of welded sheet steel for compact wall-mounting. Ideal for all applications where floor space must be kept clear. Available in 750w, 1 Kw, 1500w and 2 Kw loadings, with or without Thermostat Control. From **£10.4.11**

The first cold spells of Autumn send up the demand for Thermovent Heating—NOW is the time to prepare! The widely extended range of Thermovent Heating Equipment includes **high temperature panels, unit heaters** and a range of **thermostats** for every type of installation.
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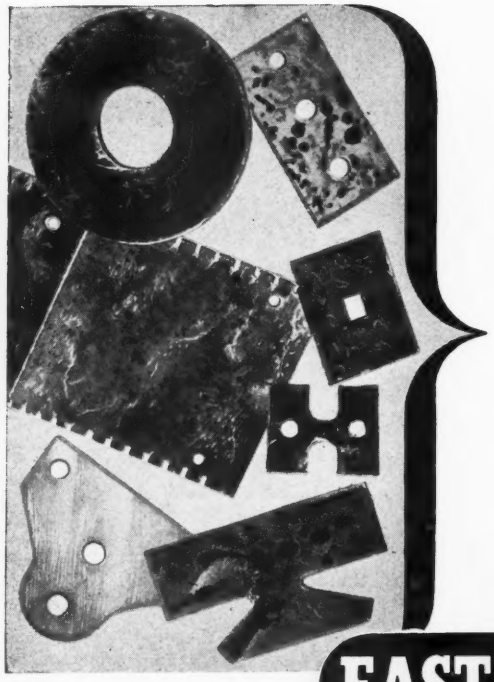

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Electrical Insulation

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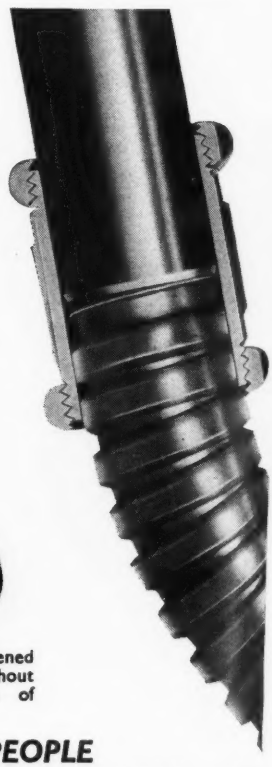
ABCON conduit coupling

(Approved by the London Electricity Board)

Just slide on the Abcon fitting, tighten up, and the joint is made.

The greatest advance in conduit technique for years. The new ABCON conduit coupling is one of the most important advances that this field of electrical work has seen for many years.

HOW IT WORKS. Tightening of the taper-threaded nut tightly contracts the slotted end of the ABCON fitting to the conduit.



For joining rigid to flexible conduit (of same outside diameter of rigid conduit).

For joining rigid to rigid (no screwing of conduit required)

Supersedes inspection elbows. Sound bonding.

Joints may be opened at any point without dismantling run of conduit.

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PUSH-BUTTON ACTION IS POSITIVE

FEATURES OF THE TYPE D-6 HAND-OPERATED STARTER

- Exceptionally Small Size
- Visual (Push-button) Indication
- Easy From-the-Front Wiring and Fixing
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- Ready Adjustment to motor current on site
- Automatic "Free Handle" Release
- Full, Positive Action

THE Type D-6 starter will open in all circumstances. Even if the contacts are so damaged by severe overloading that "welding" takes place, the thrust from the STOP button will force them apart. This definite drive—independent of springs—comes from a mechanism that links the STOP button positively with the moving contacts. In addition, when the starter is closed, the STOP button projects beyond the shroud. These two features enable a hurried blow, in an emergency, immediately to stop the motor.

RELIABLE LOW COST PROTECTION FOR THE SMALL ELECTRIC MOTOR

CRABTREE

WIRING ACCESSORIES • SWITCHGEAR • MOTOR STARTERS

"Crabtree" (Registered)

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SCALAMP

ELECTROSTATIC VOLTMETER

For high voltage measurements at zero current drain the "SCALAMP" ELECTROSTATIC VOLTMETER is the ideal instrument.* With a three-second period and hairline-spot indicator on a clear open scale, measurements can be taken with great rapidity and ease. The instrument is completely self-contained, all components being enclosed in a robust dust-proof plastic case mounted on resilient feet. Lamp illumination is effected from the mains-supply through a built-in transformer or from an external 4V battery.
Please write for descriptive leaflet.

RANGES

Cat. No.	E.R. 11308	*1 to 5 kV (a.c. or d.c.)*
	E.R. 11309	*3 to 10 kV (a.c. or d.c.)*
	E.R. 11310	*5 to 18 kV (d.c.) and 5 to 12 kV (r.m.s. on a.c.)*

*vide page 100 of Television Engineers' Pocket Book—a Newnes Publication.

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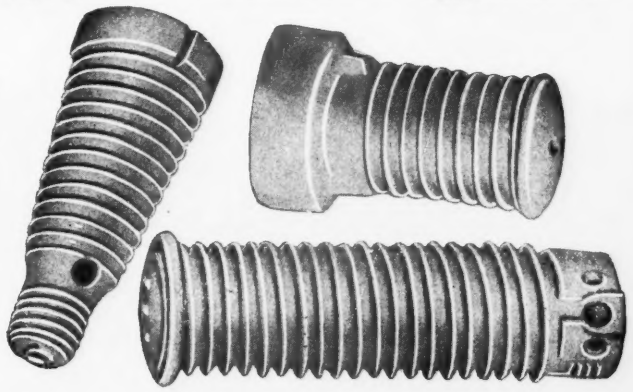

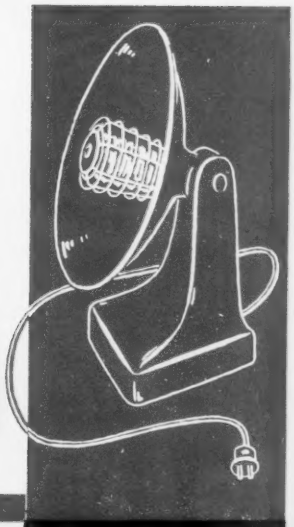

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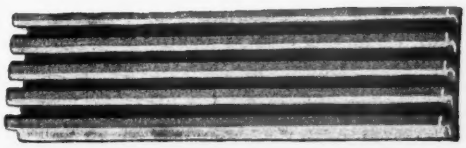

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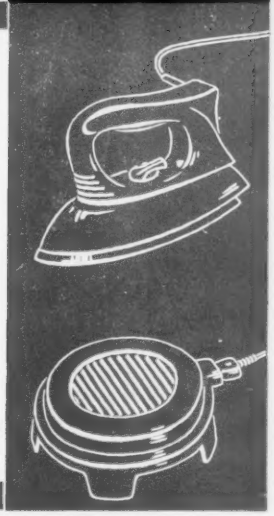

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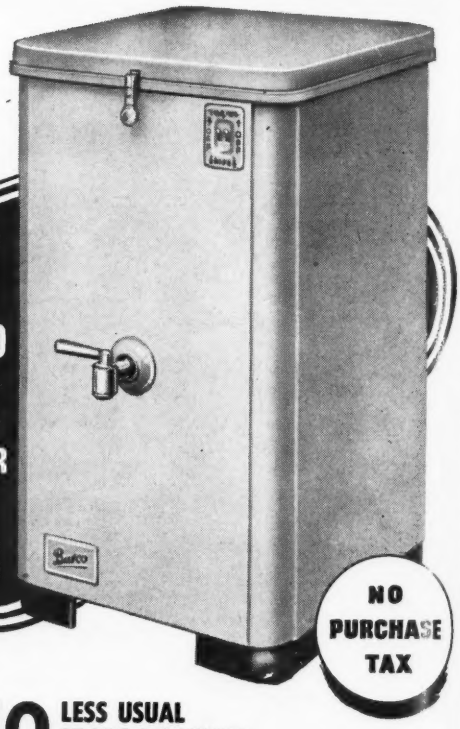

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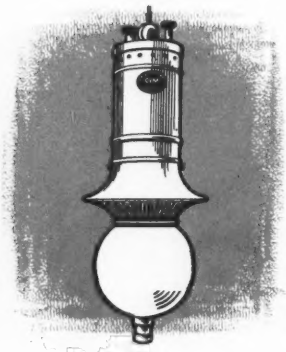

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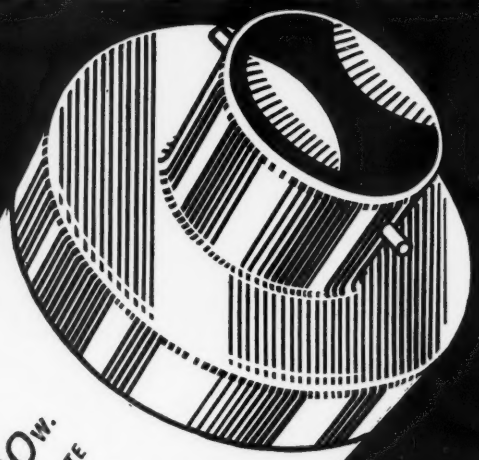

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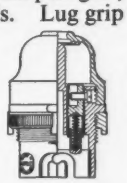

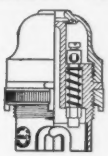

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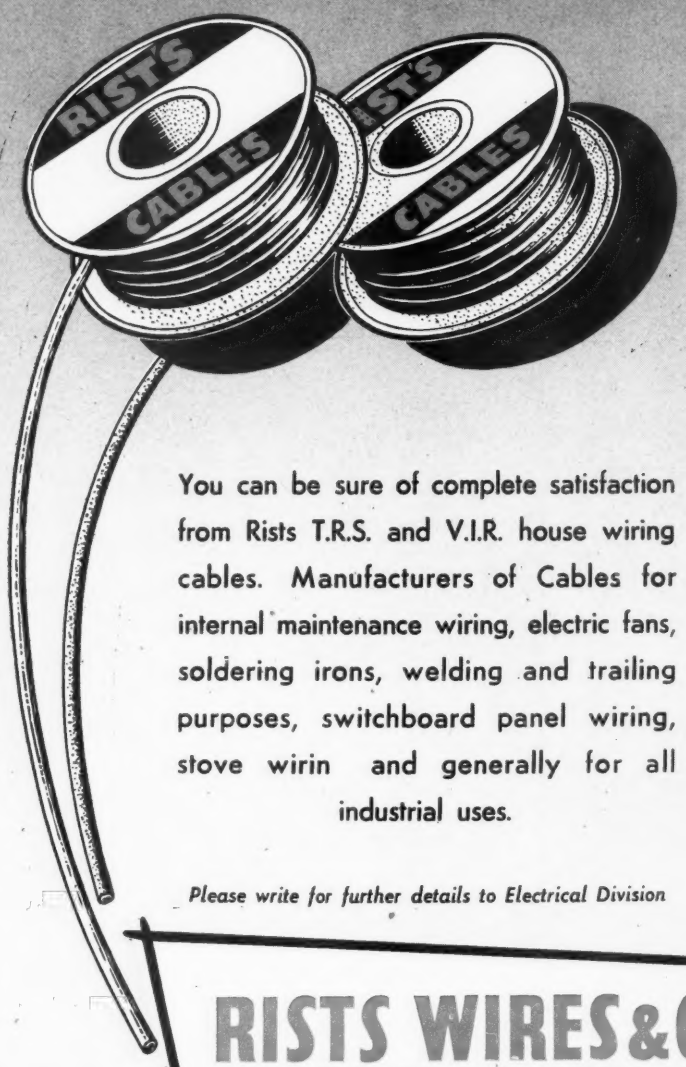

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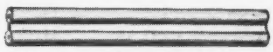
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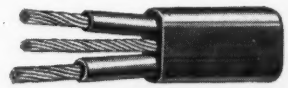
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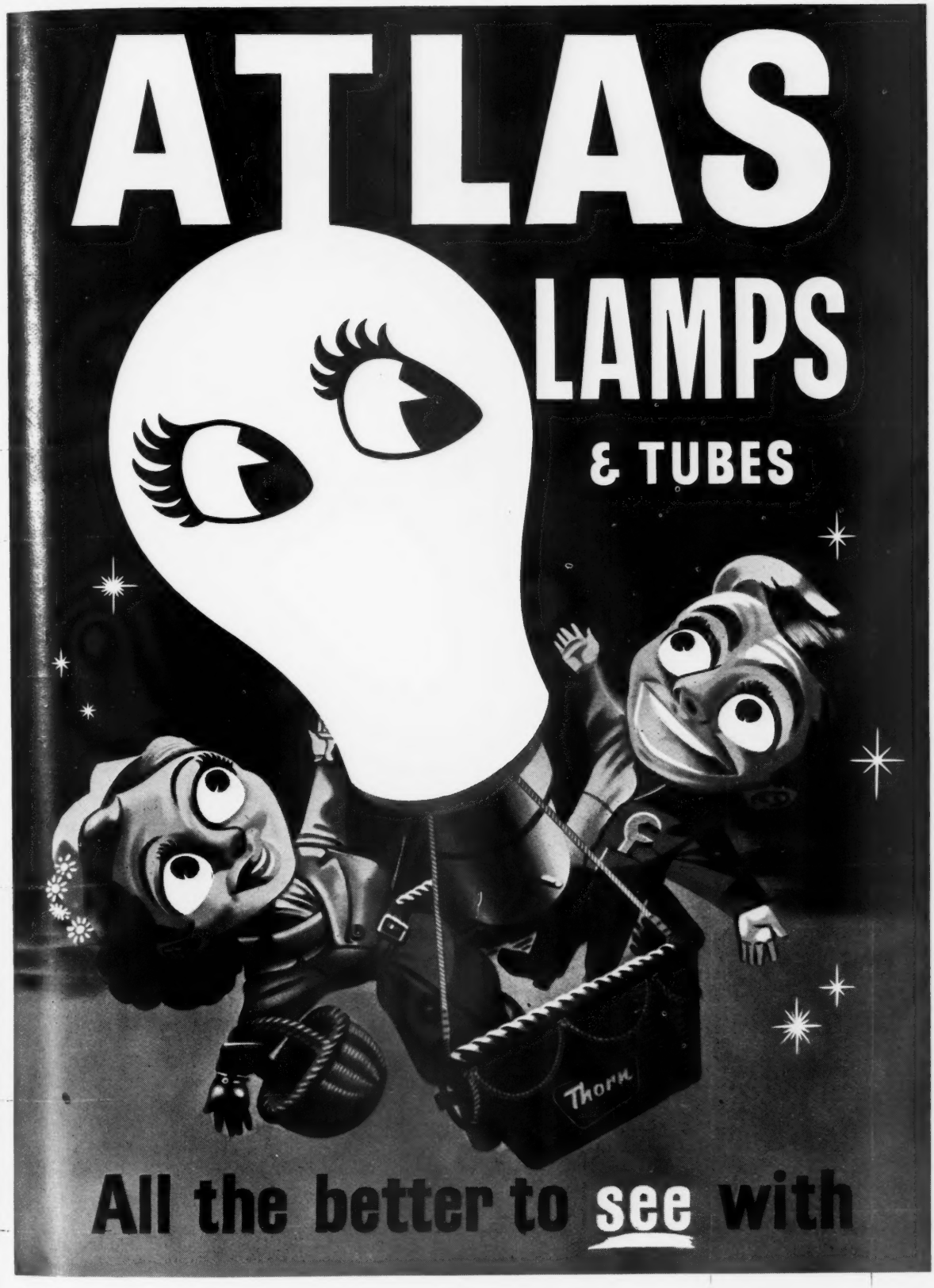

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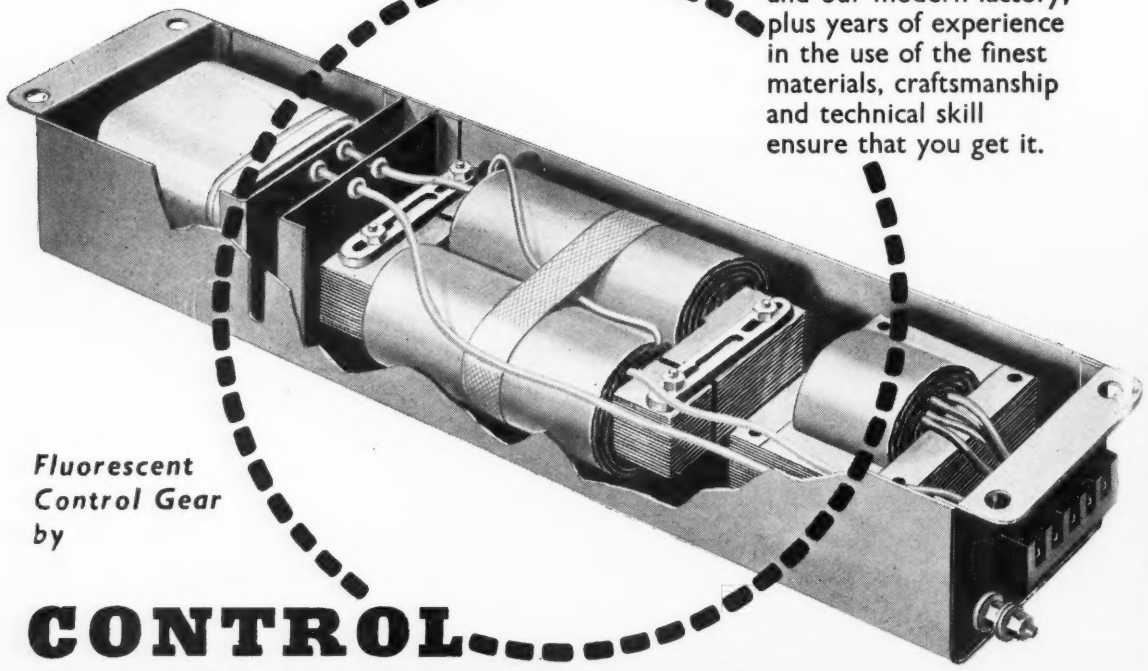

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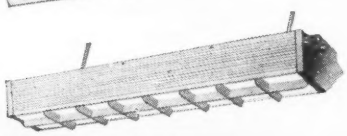

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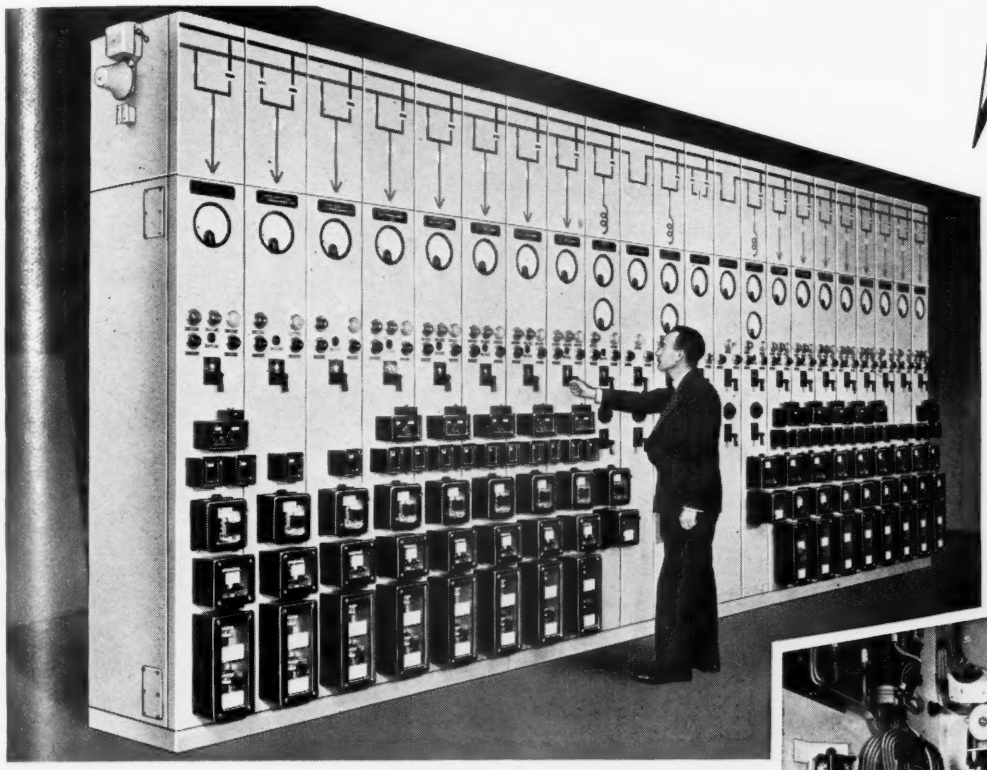

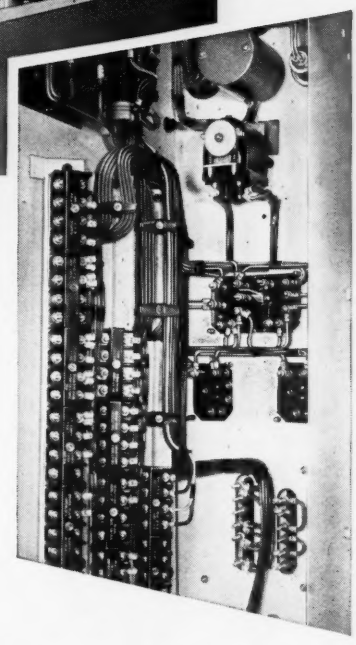

Shown here is part of
a recently completed order for
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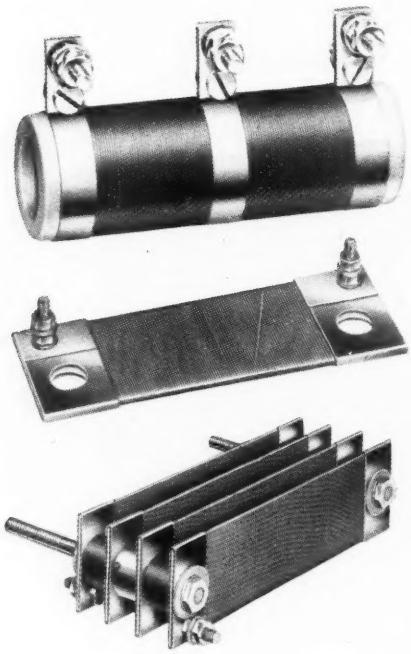

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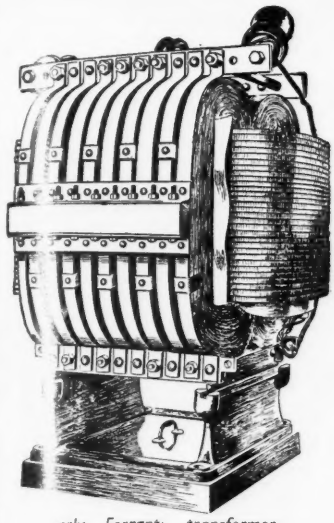

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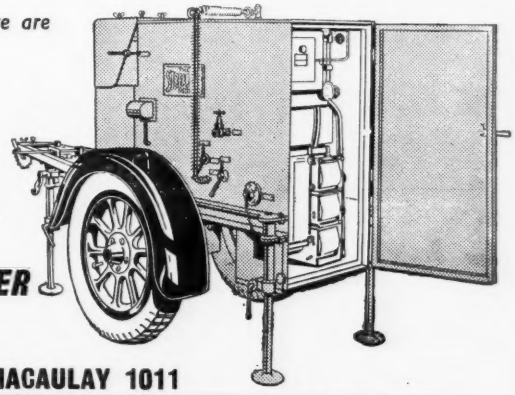

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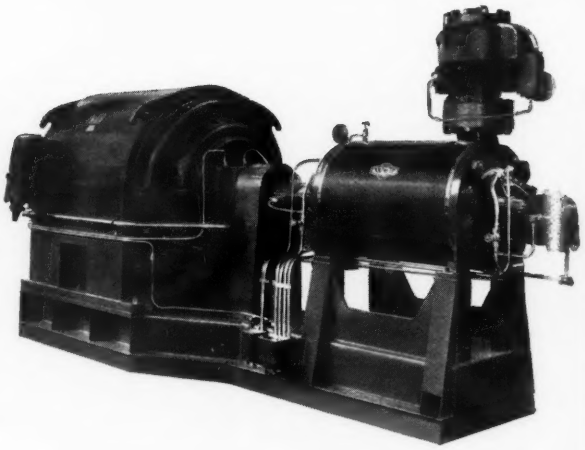

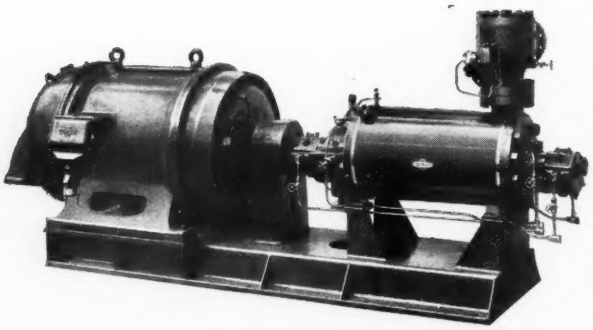

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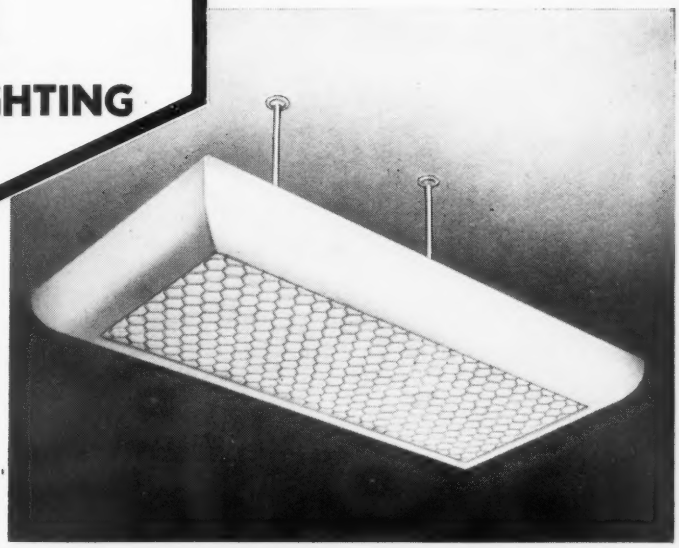

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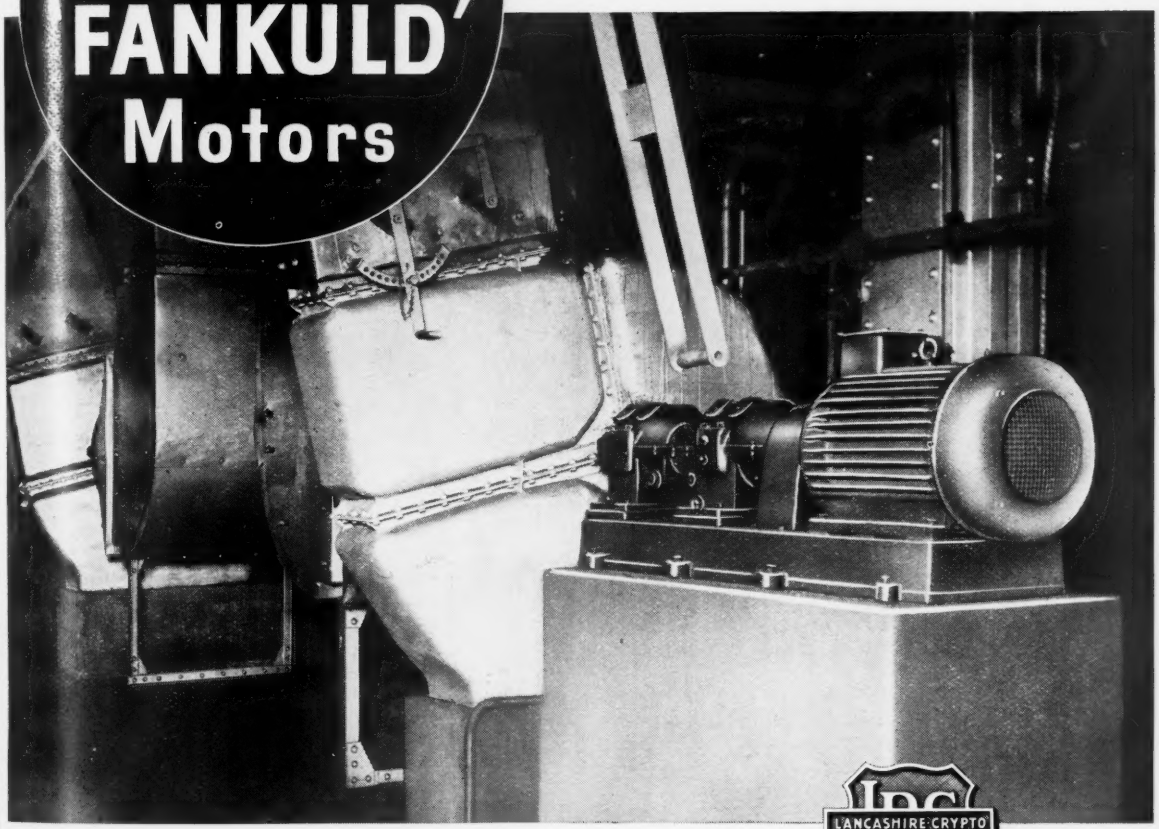

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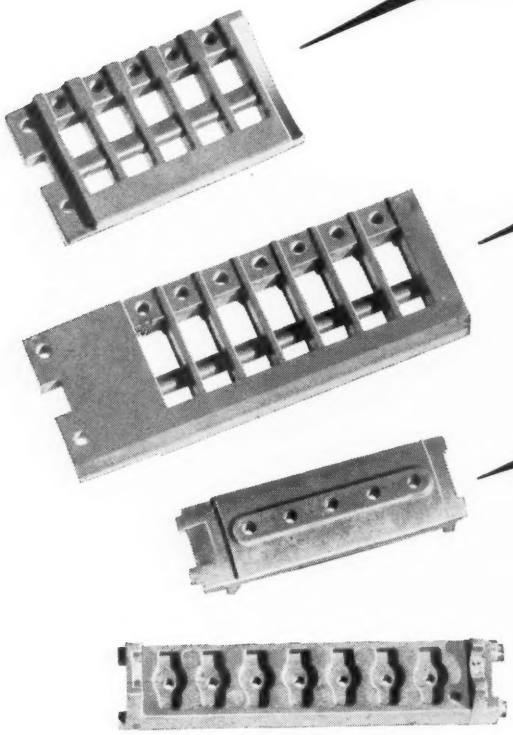

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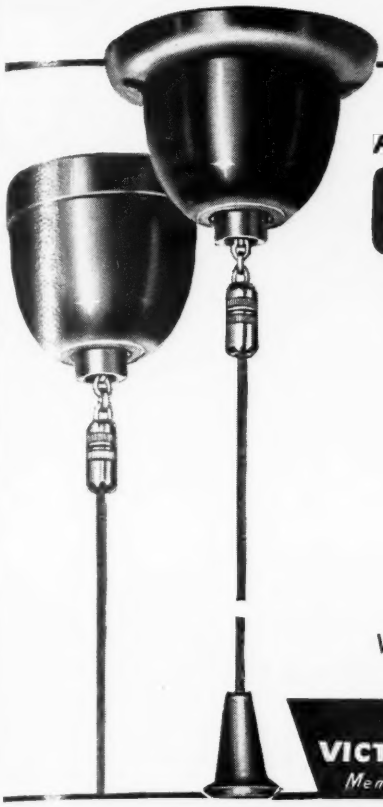

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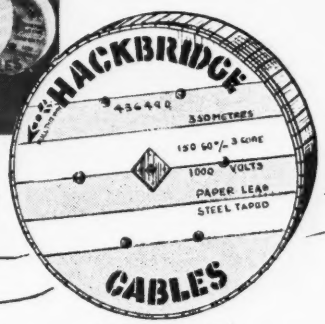

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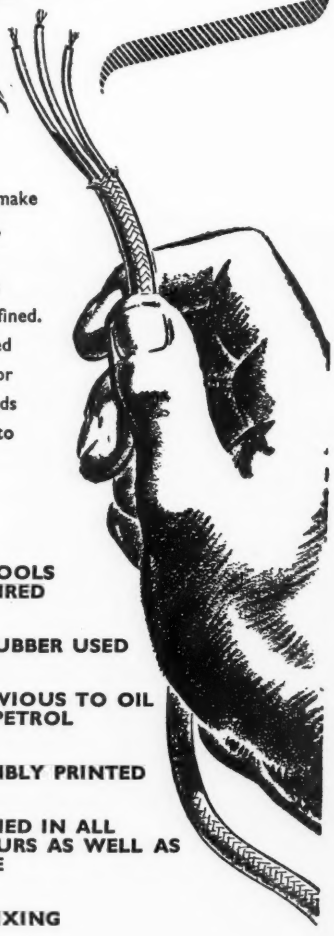

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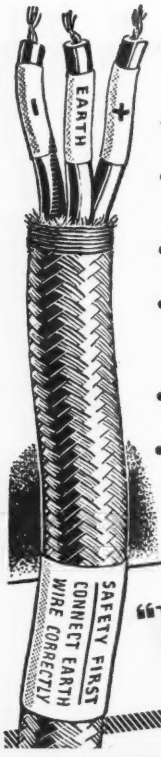

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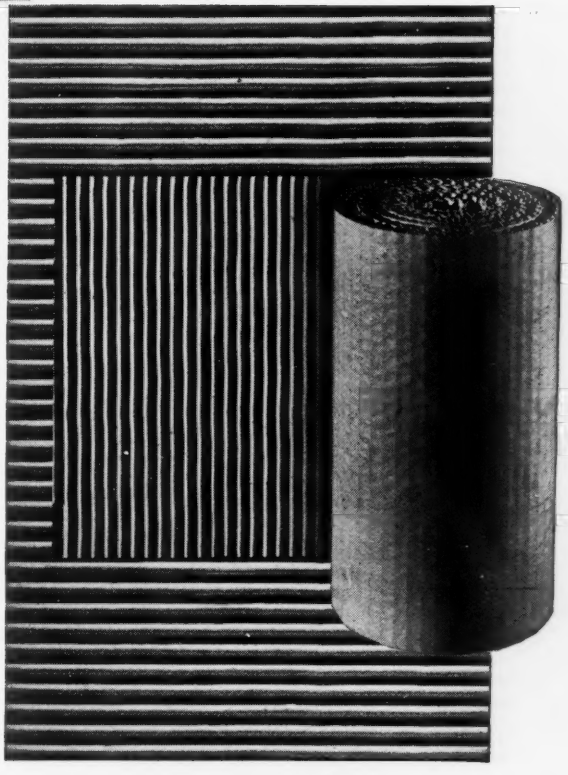

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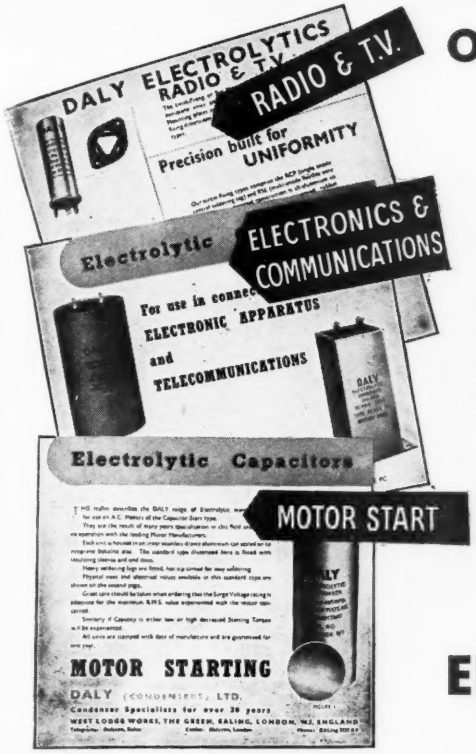

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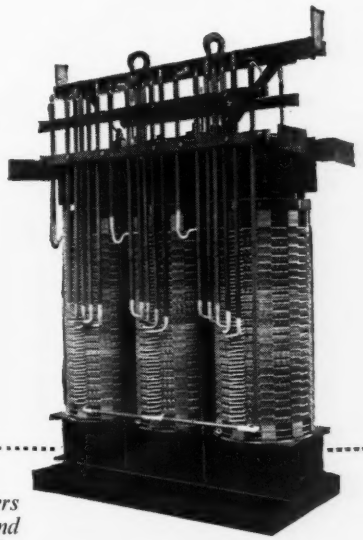

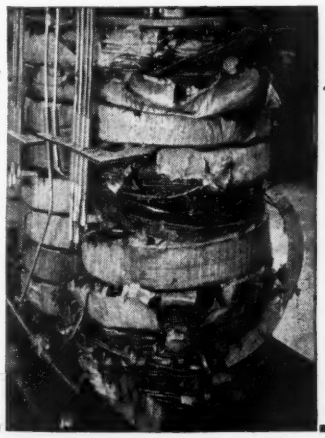

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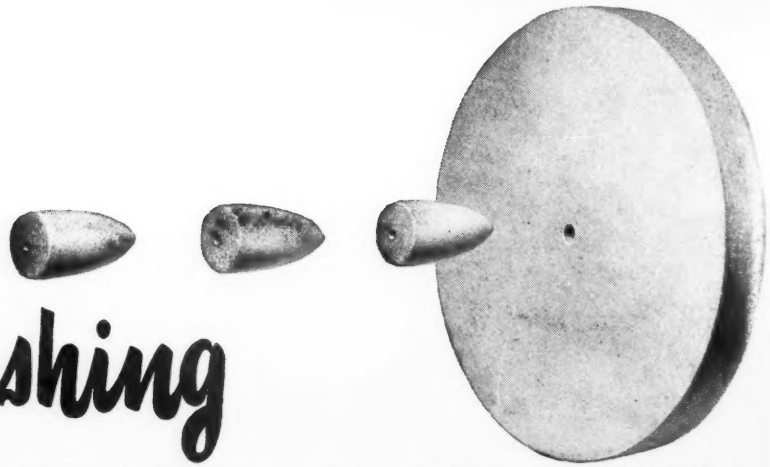

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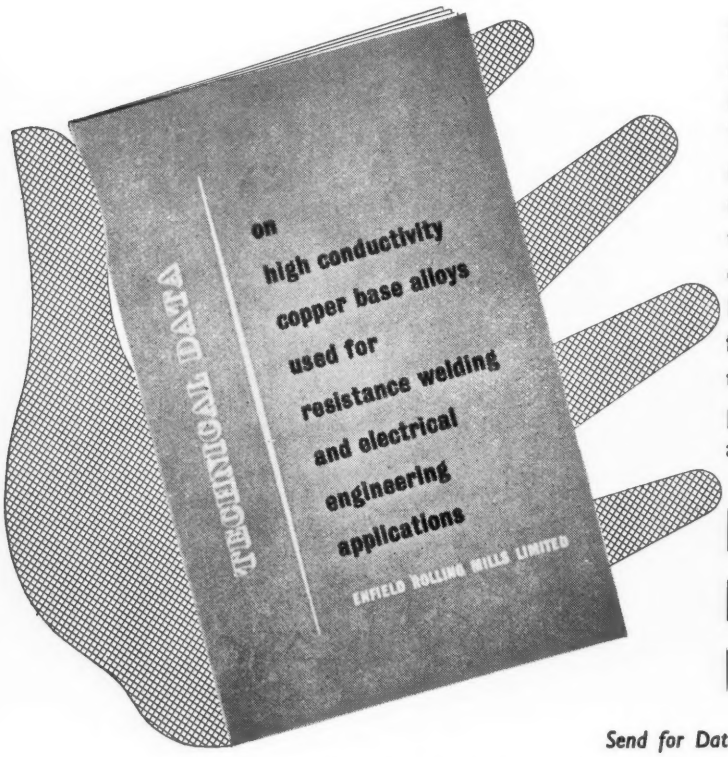

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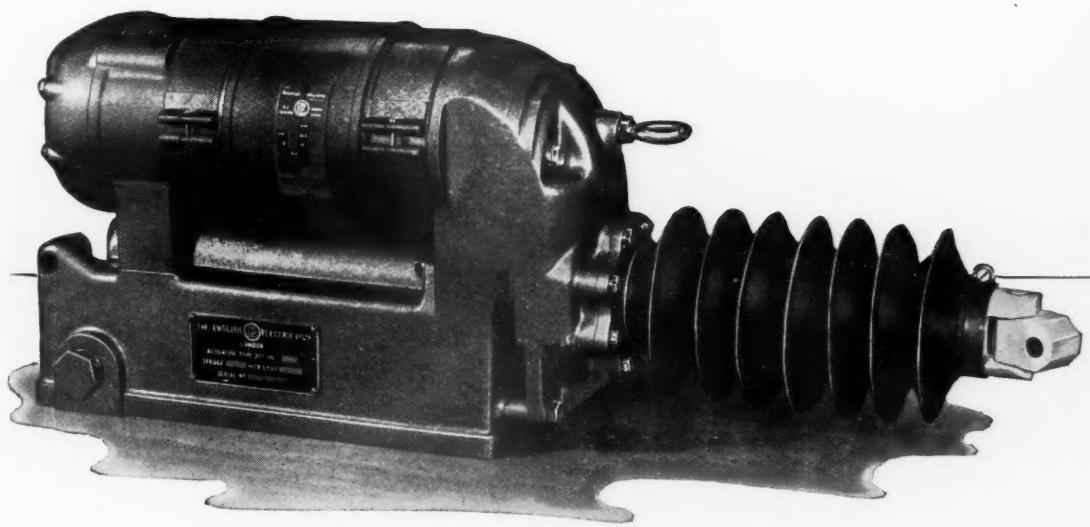

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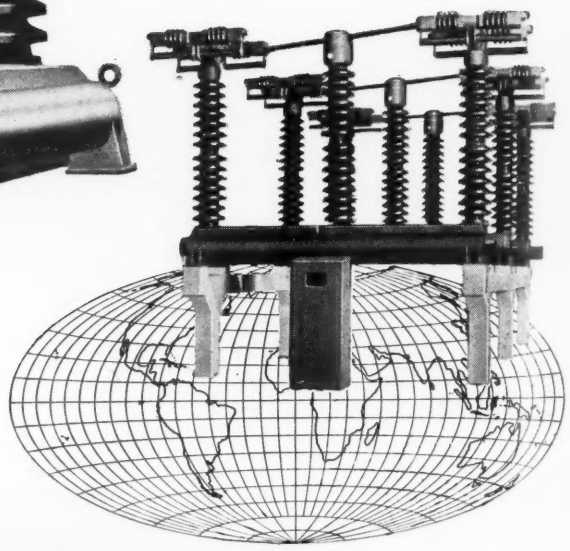

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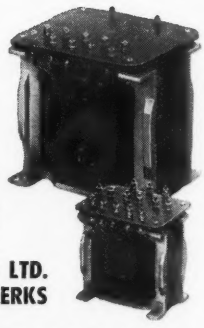

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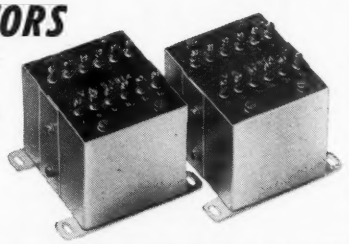

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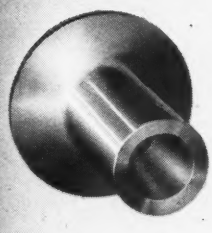

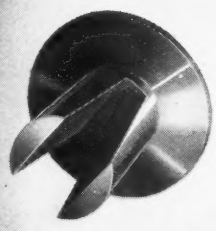

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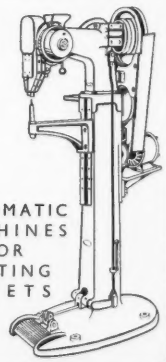

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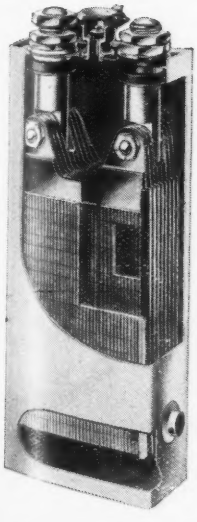

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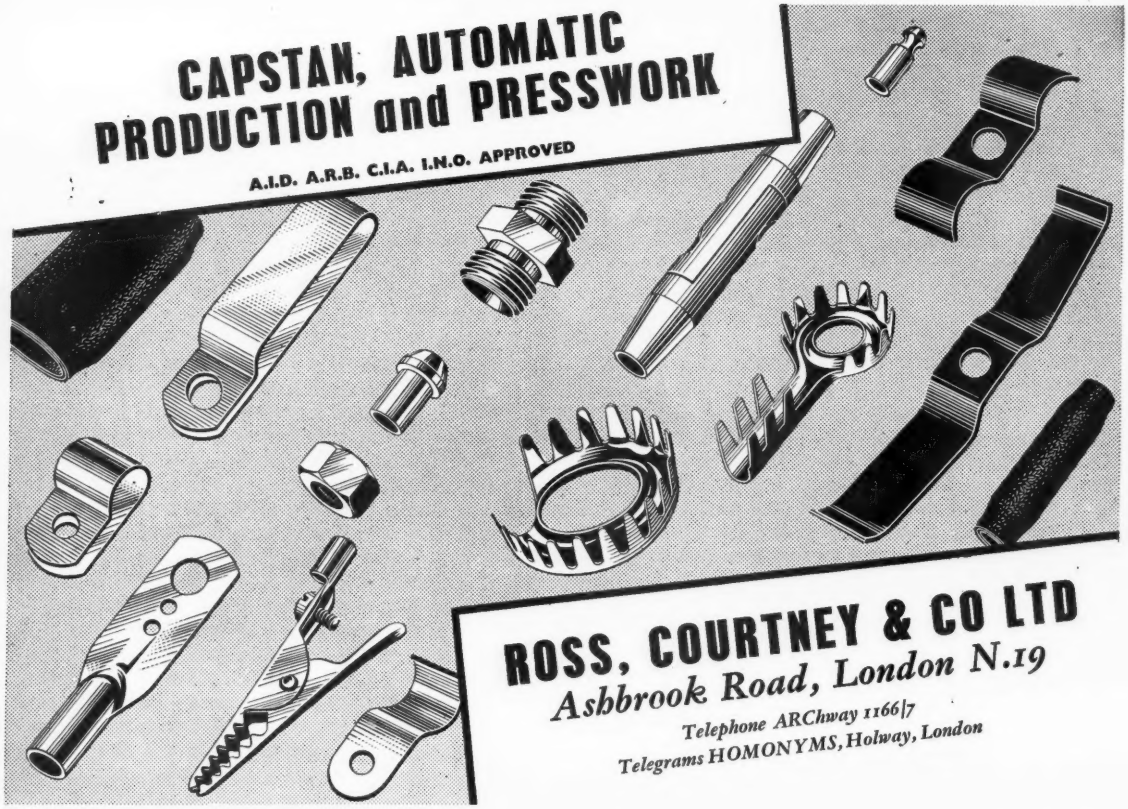

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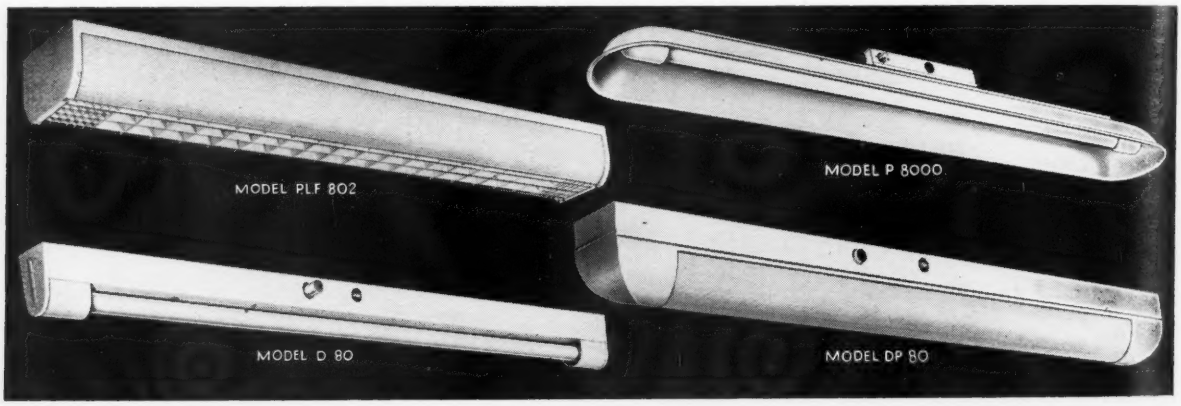

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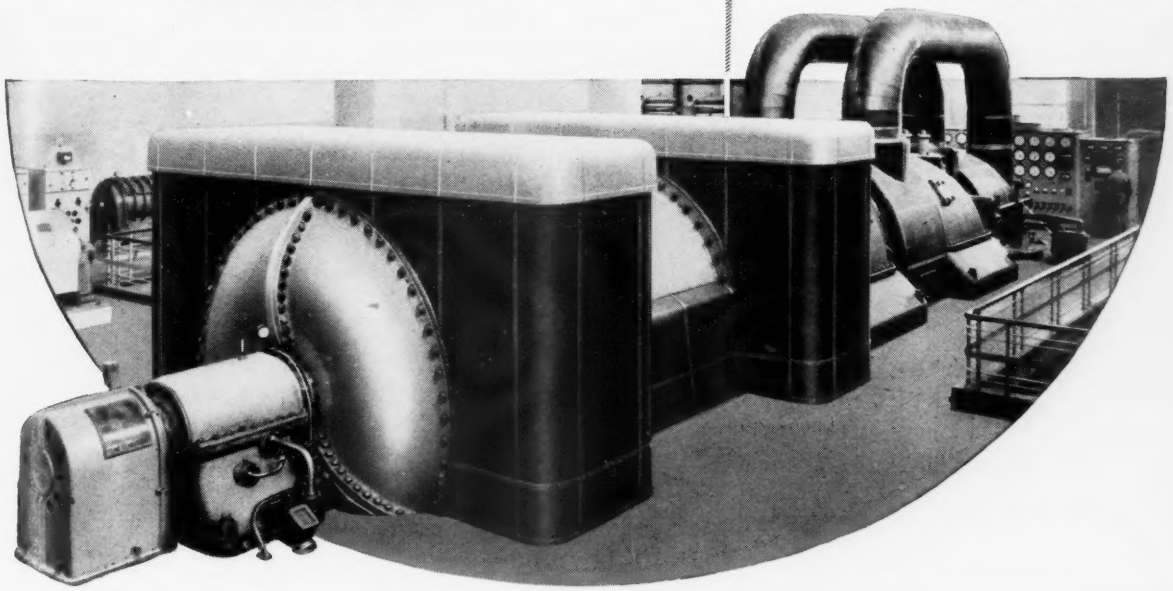

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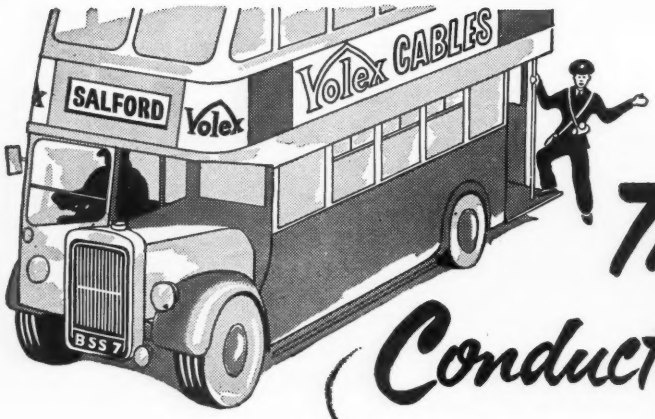

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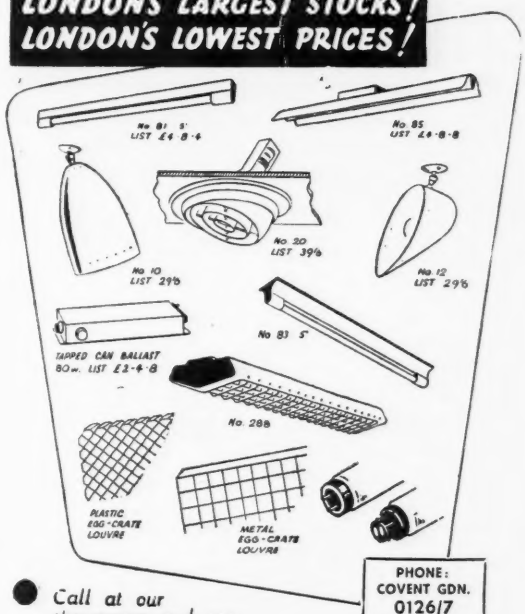

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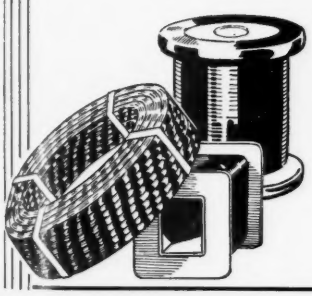
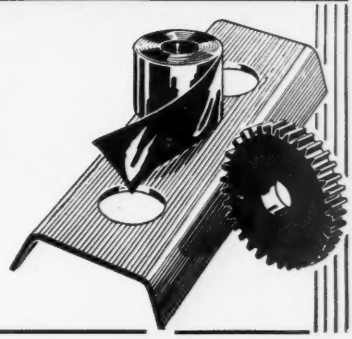
INSTRUMENT WIRES | INSULATING MATERIALS



ENAMELLED, SILK and COTTON covered Copper Wires, Single or Stranded, also Tinned, Paper, Asbestos and Plastic Westoflex covered. RESISTANCE WIRES. LITZ WIRES.

MICA, MICANITE and BAKELITE in all forms. Heat Resisting Boards. Canvasite for Silent Gears. Oil Cloth, Silk and Paper Slot Insulations. Insulation Varnishes. Varnished Fabric and Plastic Sleeving. Moulded and Machined Pieces, etc.



WEST INSULATING COMPANY LTD.
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Telephones : Abbey 2814 & 7352

ANOTHER H.T. SWITCHBOARD

Typical 11kV 250 MVA IVI switchboard embodying arc trapped circuit breakers for important industrial substation.

Write for Catalogue No. MC 6/1

(*Also for outdoor use*)

YORKSHIRE SWITCHGEAR & ENG. CO. LTD.

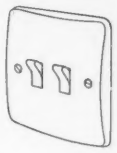
LEEDS ——— LONDON

Associated with Electro Mechanical Mfg. Co. Ltd., Scarborough

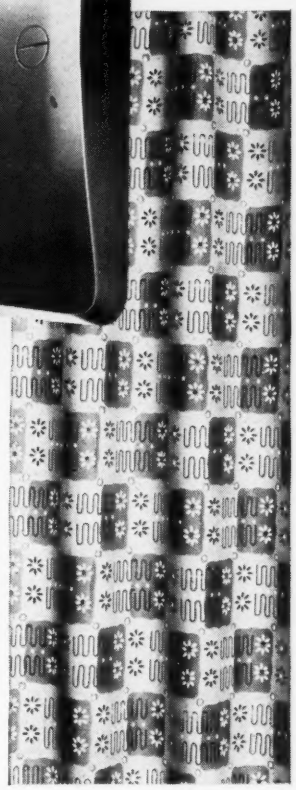
MK98DHB

the **Plateswitch** *A distinctive new development in switch design*

the Plateswitch fits into the background of modern decoration



the compact 2-gang unit has the same dimensions as the 1-gang



The clean modern lines of the new **MK Plateswitch** catch the eye immediately. Here is a design that speaks discreetly of quality. Look at it again, and every detail of its construction and finish confirms the first impression.

Easy installation, with generous, well placed terminals; B.S. 1299 fixing centres on both one and two gang patterns; automatic levelling with the plaster; smooth, silently-controlled performance—these features combine to make the **Plateswitch** as attractive as its appearance suggests. Here, too, is a distinct price appeal. The **Plateswitch** qualifies on cost for the most competitive work. Ask for Leaflet 227 and compare the value.

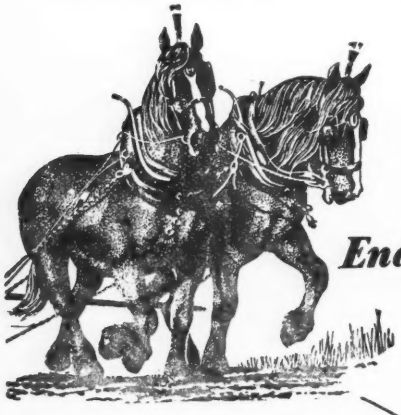
THESE ADVANTAGES SIMPLIFY STOCKING

Every **Plateswitch** is supplied with four screws to match—two 4BA for metal boxes and two No. 5 wood screws for wood boxes.

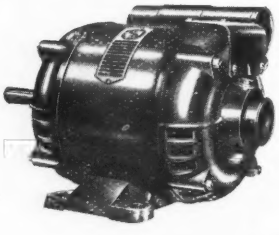
The two gang **Plateswitch** has two 2-way switches only, each or both of which can be wired as 1-way.

MK REGD *. . . the mark of leadership*

M. K. Electric Limited, Wakefield Street, Edmonton, London N.18. Edmonton 5151



For Power and Endurance



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precision built electric motors

Design:—Scientific advances with 35 years' experience.

Production:—Modern factory and tools — Strict inspection.

A.C. single and three-phase motors up to 10 H.P.

Fractional H.P. D.C. motors.

Electric truck motors up to 10 H.P. and control gear

A.C. single-phase self-regulating alternators.

Loom motors — switchgear — transformers — electronic control gear, etc.

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FLUORESCENT TUBES

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STARTER SWITCHES

for all your lighting needs

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MULTI-PLUG ADAPTORS

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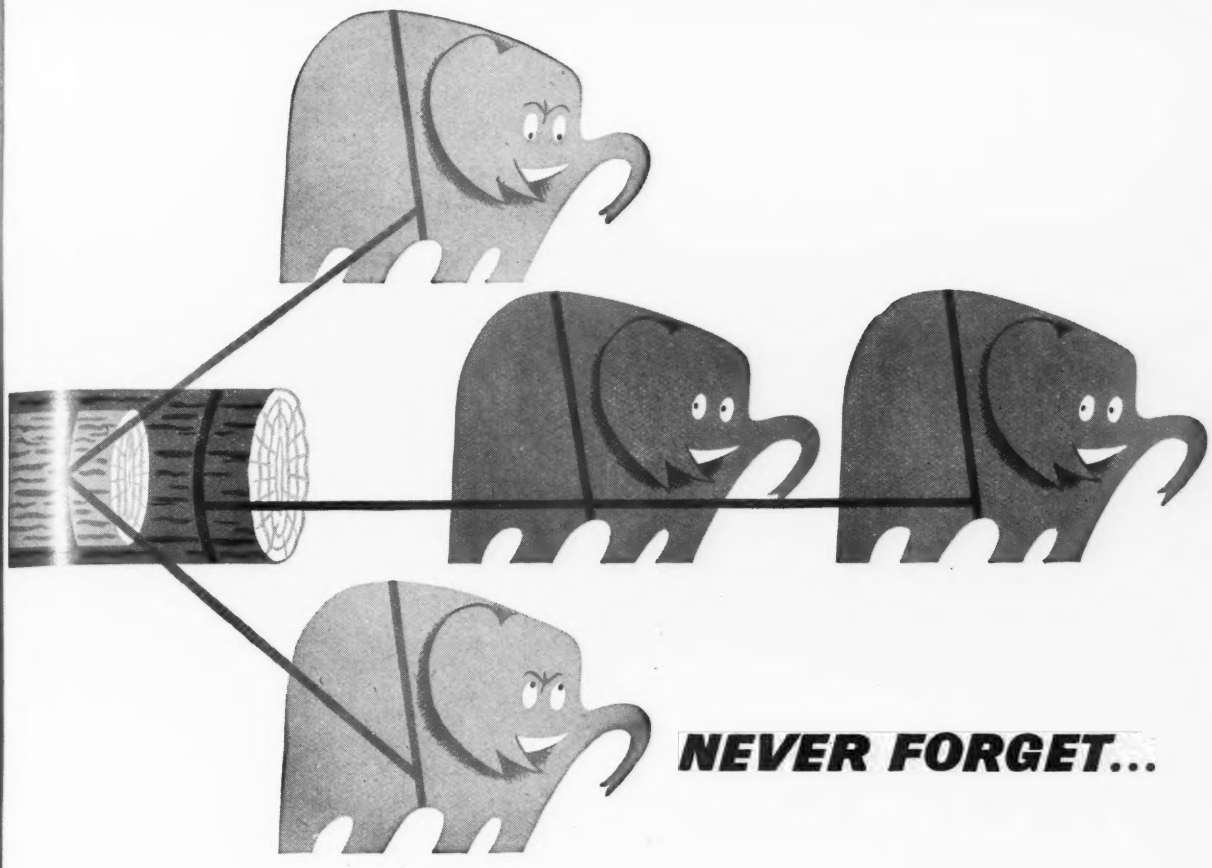
INDUSTRIAL HEATING APPLIANCES and RESISTANCE UNITS

HEDIN LTD

Commerce Estate, South Woodford

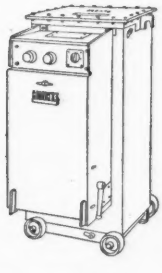
LONDON, E.18. *Tel.: BUC. 6601/2*



NEVER FORGET...

AS WITH ANY OTHER labour force, if you use electrical current efficiently it will do more useful work. Current can consist of two components, one doing useful work, the other not—*you may be paying for both.*

By installing Hunts Power Factor Improvement capacitors these elements are made to pull together so that although the same work is done, the bill for the electricity you consume is reduced. Our technical staff will be pleased to advise of the saving to be made in your plant.



If you are paying a kVA maximum demand charge, or if there is a penalty clause for low Power Factor in your company's electricity agreement, Hunts P.F.I. capacitors can probably reduce your electricity bill by a considerable amount annually.

REGISTERED TRADE MARK
HUNTS
CAPACITORS
THE TRADE MARK OF RELIABILITY
Established 1901

designed to save money

A. H. HUNT (Capacitors) LTD., WANDSWORTH, LONDON, S.W.18. Telephone: BATtersea 1083/7.
and in Canada — HUNT CAPACITORS (Canada) LIMITED, AJAX, ONTARIO

LEAD, TIN, ANTIMONY AND THEIR ALLOYS

Solder, Solder Wire
Antifriction Metal
Cable Alloys
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Members of London Metal Exchange.

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ASSOCIATED LEAD PRODUCTS

AND AT: CRESCENT HOUSE, NEWCASTLE. TELEPHONE: 36211.

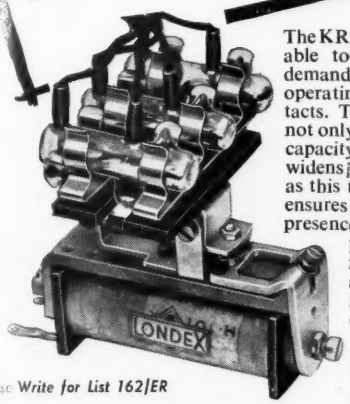
LEAD WORKS LANE, CHESTER. TELEPHONE: 21022

LONDEX TRADE MARK

SENSITIVE RELAYS

SENSITIVE MERCURY SWITCH RELAY

TYPE KR/QA



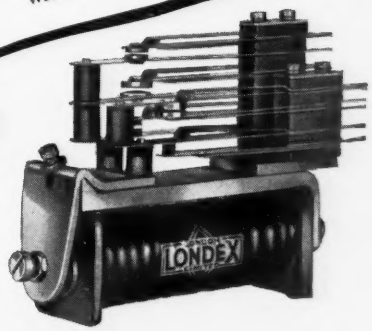
The KR/QA relay is made available to meet the increasing demand for a sensitive relay operating very heavy duty contacts. The use of mercury tubes not only increases the switching capacity of the relay, but also widens its scope of application, as this type of enclosed contact ensures safe operation in the presence of inflammable vapours and reliable action in a dusty or corrosive atmosphere. The relay is suitable for operating on D.C. systems. A wide range of windings, covering resistances up to 20,000 ohms, is available.

Please Write for List 162/ER

SENSITIVE RELAY

A D.C. Telephone Type Relay with Heavy Duty Contacts

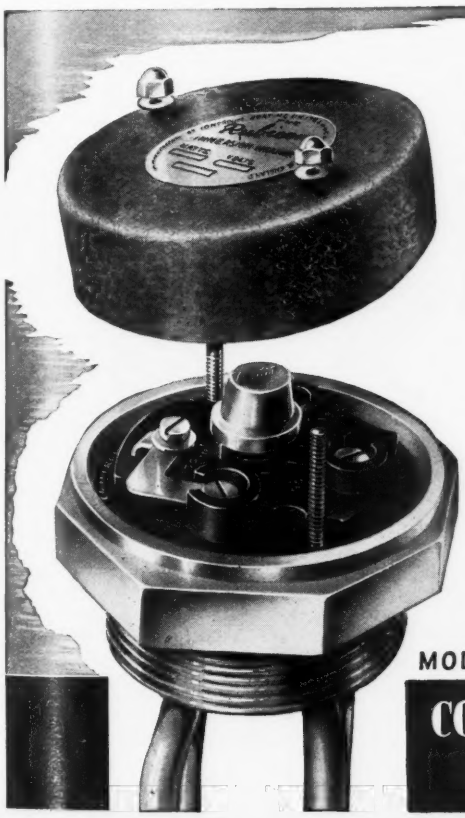
TYPE KR



It can be supplied with up to :—
Four sets of change-over contacts, or Six sets of normally made contacts, or Six sets of normally open contacts.

COIL. Consumption is from 0·1 watts.
The coil supply must be D.C. Coils are available for voltages up to 250 and for currents up to 10 amps.

LONDEX LTD., ANERLEY WORKS, LONDON S.E.20. *Telephone :* ★SYDenham 6258



5 Years Testing Proves Stemless Thermostat

"Rubicon" IMMERSION HEATER with ADJUSTABLE THERMOSTAT RANGE 100°-180°

⇨ HEAD CLEARANCE ONLY 1¾"
⇨ VERTICAL or HORIZONTAL MOUNTING
⇨ SOLID EMBEDDED ELEMENTS
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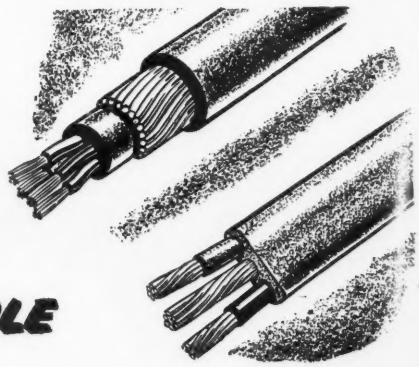
A BETTER ELECTRICAL INSTALLATION AT LOWER COST WITH ASHATHENE CABLE



Ashathene polythene insulated and p.v.c. sheathed cable has outstanding and exclusive features which make it superior to V.I.R. and p.v.c. insulated cables. When you install Ashathene you ensure a safer electrical installation.

- Higher Voltage Insulation
- Higher Dielectric Strength
- Better Fire Resisting Qualities
- Unaffected By Corrosive Atmosphere
- Easier and Quicker to Install
- Reduced Cost

Ashathene can be laid directly into cement or plaster without any detrimental effect occurring.

Ashathene is also available in a wide range with single or double wire armouring with an overall p.v.c. sheath. Special sealing glands are available which positively prevent moisture ingress into distribution boxes, etc.

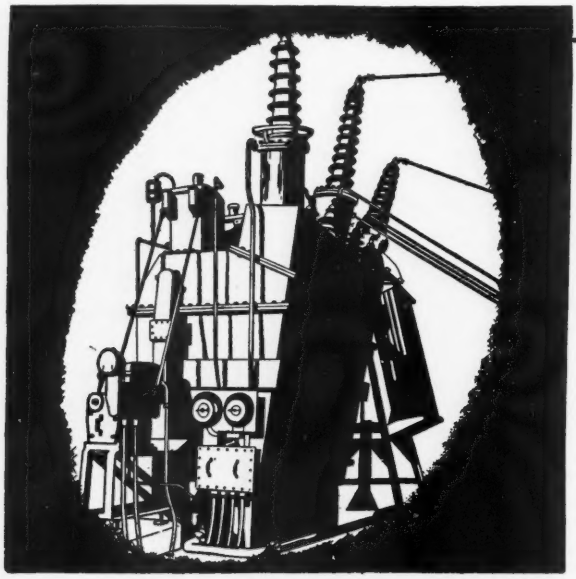
Ashathene is being supplied in large quantities to the National Coal Board, Electricity Boards, etc., and is extensively used in housing and industrial projects, including chemical and plating works for which it has special advantages.

NO WONDER ASHATHENE IS BEING USED MORE THAN EVER!

AERIALITE LTD. CASTLE WORKS STALYBRIDGE CHESHIRE

Depots at: LONDON ● BRISTOL ● BIRMINGHAM ● MANCHESTER ● NEWCASTLE ● GLASGOW

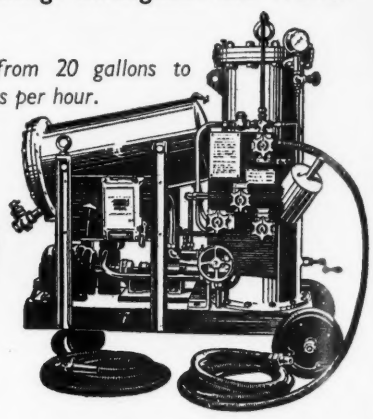
THIS IS AN ADVERTISEMENT OF THE AERIALITE LTD. GROUP OF COMPANIES



TRANSFORMER AND SWITCH OILS

Complete Drying and Purification giving Maximum Breakdown Voltage in one simple operation. No heating. No fire risk. Weatherproof. Fully mobile units. Used by leading Electricity Undertakings throughout the World.

Capacities from 20 gallons to 1,000 gallons per hour.



METAFILTRATION

THE METAFILTRATION COMPANY LIMITED
BELGRAVE ROAD, HOUNSLOW, MIDDLESEX

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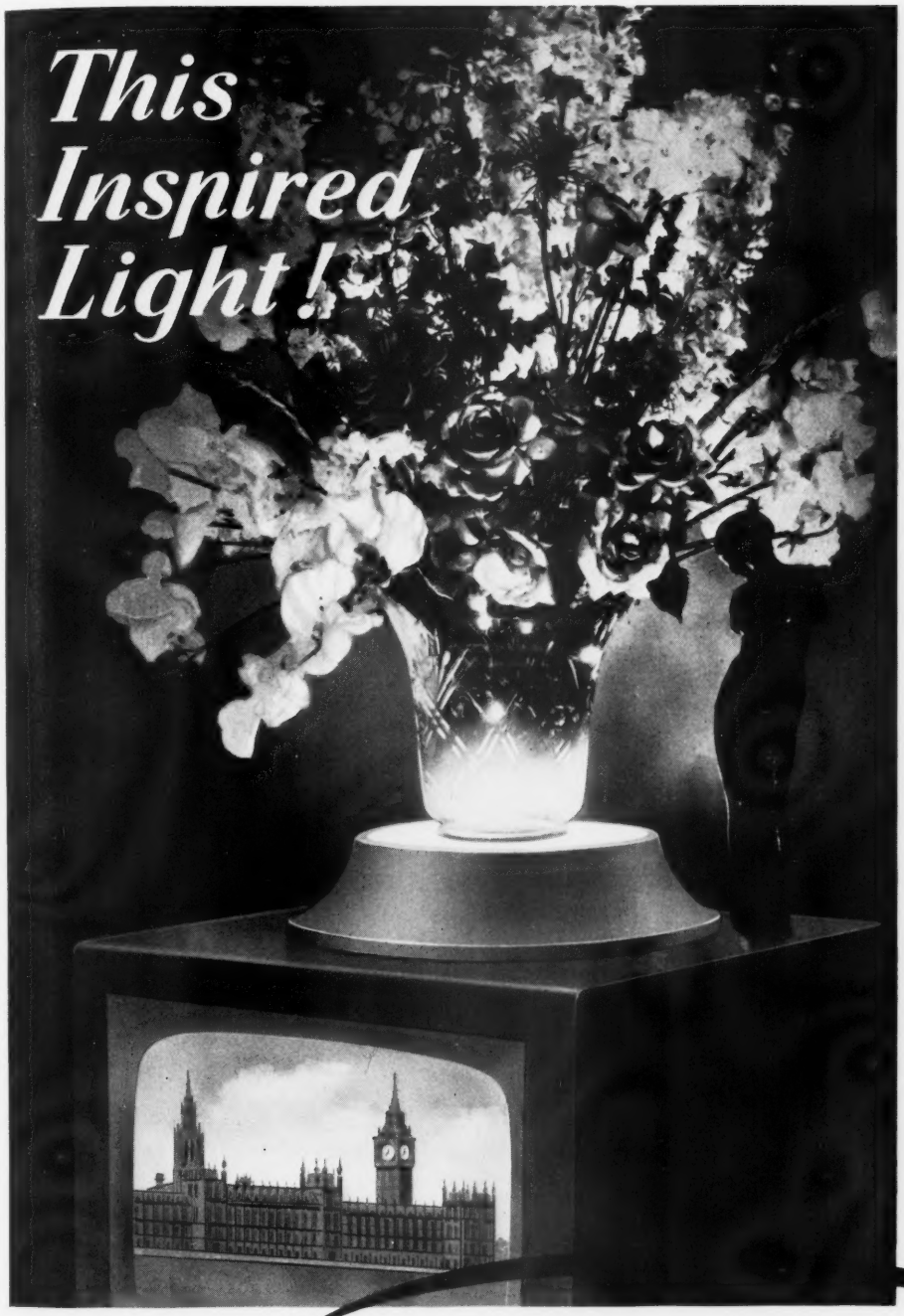
GRAMS: METAFILTER, HOUNSLOW



The R.E.A.L. Plinth Light

PATENT No. 659876

Perfects the Picture

Publication No PLC/19
D

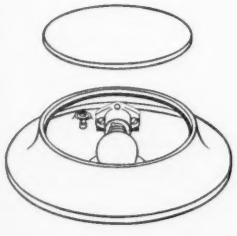
HOMES AND GARDENS
PUNCH
PICTURE POST
RADIO TIMES
This Inspired Light
TV mirror
HOUSE Wife
IDEAL HOME
MILLIONS WILL READ THIS SEASONS NATIONAL ADVERTISING IN OUR WIDER PUBLICITY CAMPAIGN FOR THE R.E.A.L. PLINTH
RADIO TIMES ANNUAL
Most good Electrical & Radio Stores can supply
This message, prominently displayed in every advertisement for the R.E.A.L. Plinth will appear in pages of the most popular Home, Radio and T.V. Journals from now to Christmas. Last year our National publicity resulted in record Plinth sales to stockists everywhere. This year's campaign is on an even greater scale. Advertisements so far arranged include :—
RADIO TIMES, Oct. 22
RADIO TIMES ANNUAL
PUNCH, Oct. 13 & 27, Nov. 10 & 24
T.V. MIRROR, Sept. 11 & 25, Oct. 9 & 23, Nov. 6 & 20
IDEAL HOME, Sept., Oct., Nov.
HOMES & GARDENS, Oct., Nov.
PICTURE POST, Sept. 25, Dec. 4 & 11
HOUSEWIFE, Dec.
—apart from announcements in the Daily and Sunday Press.
Are you stocked to ensure YOUR share of Plinth Light prosperity ?

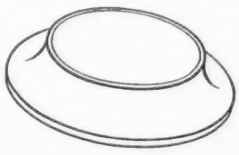
The R.E.A.L. Plinth Light

A Glory to home lovers . . . . the ideal light for Televiewers!

The appeal of the R.E.A.L. Plinth Light is universal; Televiewers have acclaimed it the perfect, unobtrusive light that counters eye strain when viewing the screen. Home lovers have enthused about its delightful effect in the decoration of any room . . . its economy in use . . . its charm as a table decoration, its ability to lend enchantment to the simplest of floral displays. It fills the universal need for cultured expression.

Each R.E.A.L. Plinth is beautifully finished in either Pastel Cream, Gilt Lustre, Eggshell Black, Pastel Rose or Pastel Blue and is supplied with B.C. Shockproof Porcelain Lampholder, three yards of two-core flexible cord and heavy glass diffusing plate.





R.E.A.L. STANDARD PLINTH LIGHT

List No. 5000

Diameter at Top	8″
Diameter at Base	11½″
Overall Height	2⅞″
To accommodate 15 watt, or 25 watt B.C. Lamp.	

Price **36/9d.** each. Tax Paid.

R.E.A.L. JUNIOR PLINTH LIGHT

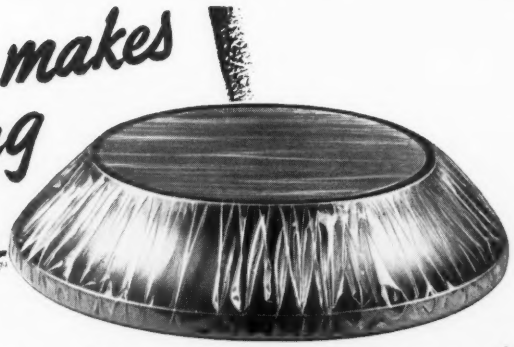
List No. 5002

Diameter at Top	5¾″
Diameter at Base	6½″
Overall Height	2⅛″
To accommodate 15 watt B.C. Pygmy Lamp, or 25 watt B.C. Tubular Lamp.	

Price **28/-** each. Tax Paid.

There is also a R.E.A.L. HOTEL PLINTH, List No. 5004, accommodating up to 60 watt lamps.

This NEW presentation makes PLINTH LIGHT selling still easier!



AND NOW—THE PERFECT WRAP!

Moisture proof and dust proof, this pleated Cellophane wrap permits full inspection and handling by the potential customer, the final purchaser receiving the Plinth in its immaculate, factory fresh condition.

ALSO — THE PERFECT PACK!

Free Rail Certified Containers, holding 12 Plinths of a size, are now the standard method of dispatch. Each pack carries a schedule of colour content. When opened, the sealed transparent wrap gives immediate view of the colour assortment. An analysis of sales over the past four years, shows that the public demand, per dozen, is divided in the following proportion: 6 Pastel Cream, 2 Gilt Lustre, 2 Eggshell Black, 1 Pastel Rose and 1 Pastel Blue. This, therefore, is our standard colour selection — but, of course, any colour assortment can be supplied. Broken quantities carriage extra, plus part cost of packing.

Thousands of private purchasers write to us annually asking where they can buy a R.E.A.L. Plinth. As most Plinths are distributed by one or other of our authorised Wholesalers, we find these enquiries not only embarrassing, but expensive! R.E.A.L. is not a departmental store with a mail order section. We have done the spadework— WHY NOT JOIN WITH US IN REAPING THE HARVEST?

—and ample counter publicity too!

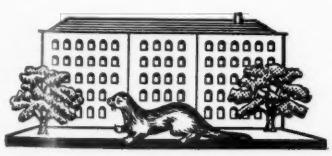
Attractive showcards, leaflets and price tickets are provided with each pack.

Issued by Rowlands Electrical Accessories Ltd., R.E.A.L. Works, BIRMINGHAM 18

OIL CIRCUIT BREAKERS

TYPE TESTED 25 M.V.A. OTTERMILL type F.D. Oil Circuit Breakers are generously designed to comply with BSS. 936/40 for 440 volts A.C., and in consequence are eminently suitable for general industrial service in factories, mills, dockyards, public buildings, etc. They are available in draw-out and non-draw-out types, ratings 100 to 600 amps, for both cubicle and independent mounting.

Illustrated catalogues will be forwarded on application.

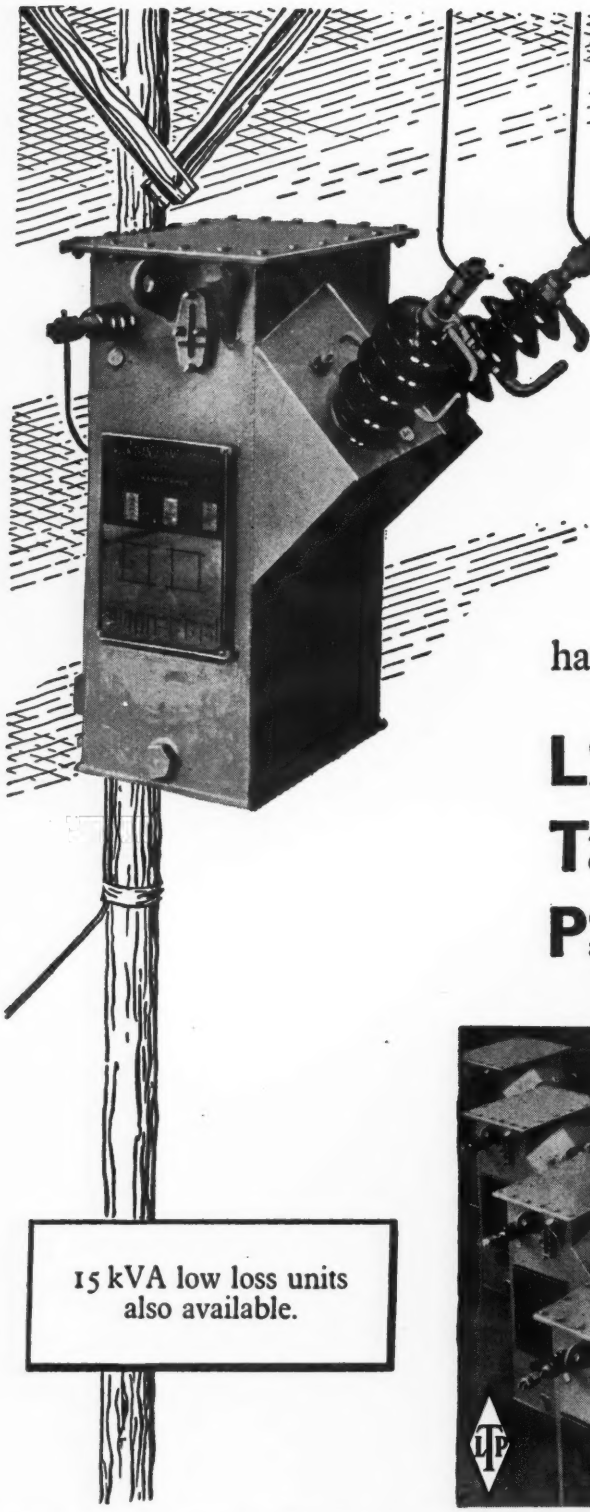


OTTERMILL SWITCHGEAR LTD

Sales Office:

1 Victoria Street London SW1 Telephone: ABBey 5095 Telegrams: Busbar Sowest London

Works: The Otter Mill, Ottery St. Mary, Devon. Telephone: Ottery St. Mary 264 Telegrams: "Busbar, Ottery St. Mary"



15 kVA low loss units also available.

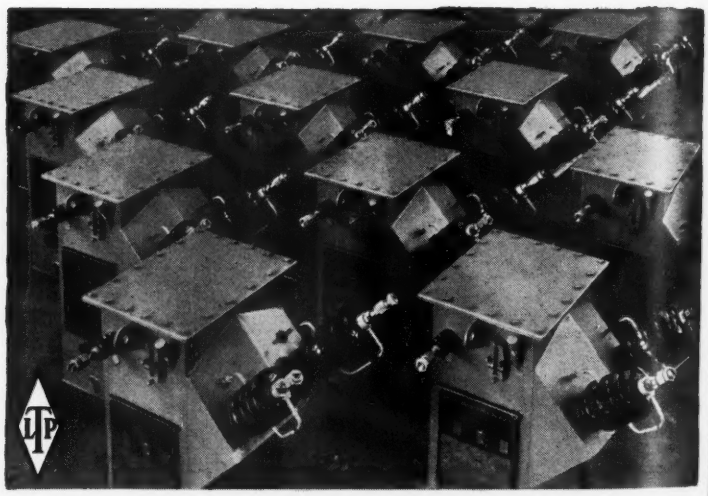
Transformers for Rural Distribution

have the following advantages –

LOW LOSSES and high overload capacities; 4.5 kVA normal rating; ratio 11,000/250V.

TANKS have single bolt fixing, domed cover, oil gauge and thermometer pocket.

PORCELAIN BUSHINGS easily replaced on site; solderless connectors and H.V. arcing horns.

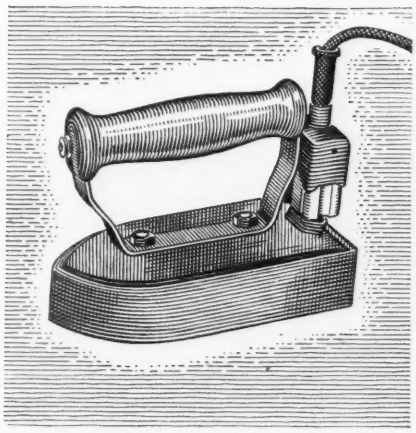


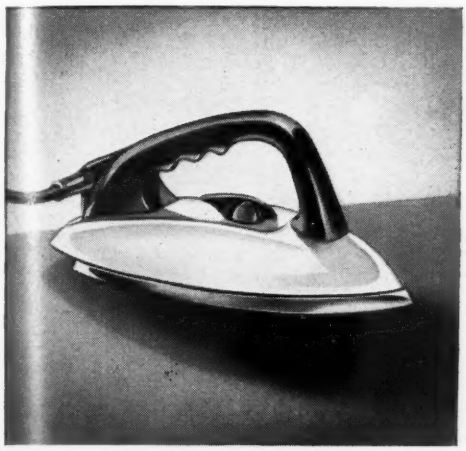
LONDON TRANSFORMER PRODUCTS LTD.

Head Office: *Telephone: Willesden 6486*
COBBOLD ESTATE, LONDON, N.W.10.

Main Works: *Telephone: Bridgend 901*
GATE ROAD, TRADING ESTATE, BRIDGEND, GLAMORGAN.

Progress in design





Since the early days of domestic electrical heating a great deal of research has been done. The result : the Brightray series of nickel-chromium resistance materials — outstandingly reliable, and with special grades to suit all domestic and industrial applications. Let us help you select the one most suitable for *your* requirements.

BRIGHTRAY C for intermittent heating and cooling cycles up to 1150°C: particularly suitable for fires, irons, cookers, heating plates, etc.

BRIGHTRAY S for electric furnace elements working almost continuously at temperatures up to 1150°C.

BRIGHTRAY B for all types of element where temperature does not exceed 950°C.

BRIGHTRAY F for furnace elements operating in a carburising atmosphere not above 1000°C.

WOULD YOU LIKE A HANDBOOK . . .

containing complete data on our electrical resistance materials? We will gladly send it free of charge on hearing from you on your business letterhead.

BRIGHTRAY reliable HEATING ELEMENTS

'Brightray' is a registered trademark.

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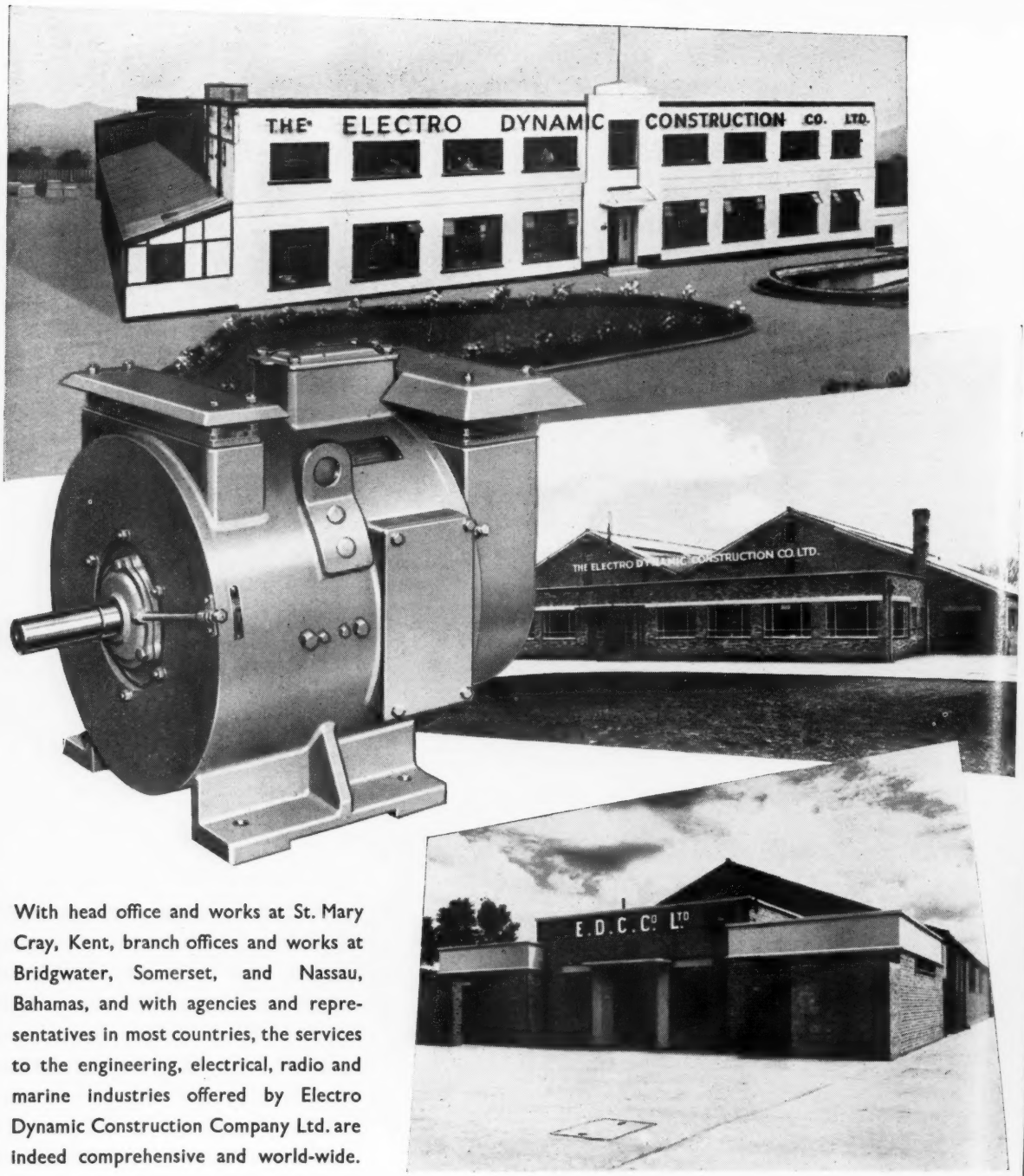

With head office and works at St. Mary Cray, Kent, branch offices and works at Bridgwater, Somerset, and Nassau, Bahamas, and with agencies and representatives in most countries, the services to the engineering, electrical, radio and marine industries offered by Electro Dynamic Construction Company Ltd. are indeed comprehensive and world-wide.

Manufacturers of motors, generators, high and low frequency alternators, etc., for every application.

AUTOMATIC CONTROL GEAR AND EQUIPMENT

ELECTRO DYNAMIC CONSTRUCTION COMPANY LTD.

ST. MARY CRAY, KENT *Phone: Orpington 2560/3*

Control Gear Works: **BRIDGWATER, SOMERSET** *Phone: Bridgwater 2882*

519 A

BRITISH-MADE
SILICONES
in the service of the
ELECTRICAL INDUSTRY
A NEW *class of* INSULATION

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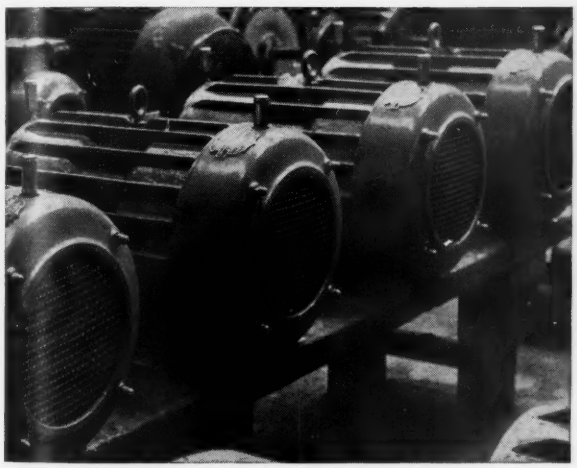

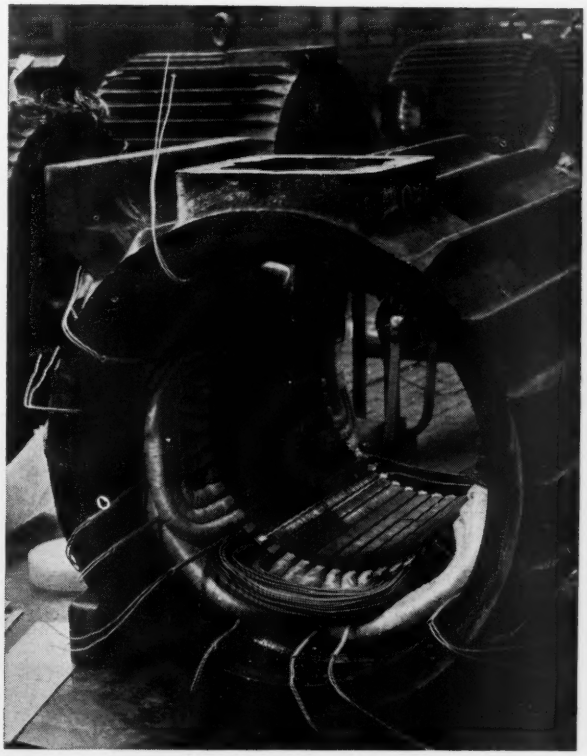

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17 SEPTEMBER 1954

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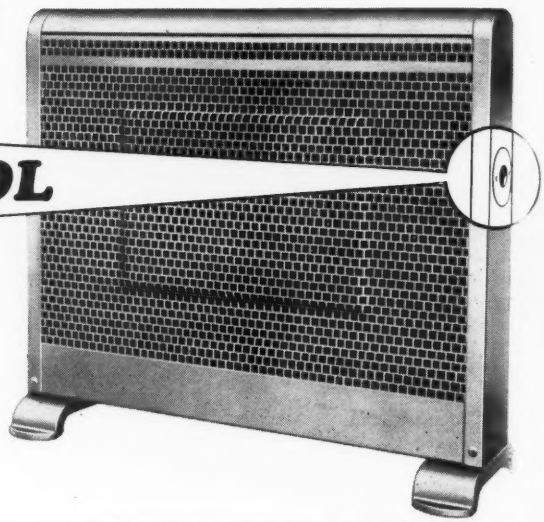

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ELECTRICAL REVIEW

17 September 1954 Vol. 155 No. 12 Established 1872

Industrial Lighting

LIGHTING has been termed a "tool" of industry because it is a means of increasing and improving production. That good lighting has this attribute is self-evident, but it is extremely difficult to assess the results with any accuracy. That is why the term "tool" is not very apt. Where processes and machines (including handling equipment) are concerned measurement of results is possible and improvements brought about by time and motion study can be gauged. But where lighting is concerned many extraneous influences operate to make exact assessment practically impossible. Nevertheless it is axiomatic that adequate and correctly distributed light is essential in the achievement of maximum production.

But if illumination is regarded as more of an art than an exact science, it is still true that it involves the application of scientific principles. While there must be a strong element of empiricism in it, considering the varied requirements of widely-different industries, mere trial and error methods are not likely to produce the best installations. For some years now the manufacturers of lamps and lighting fittings have made intensive studies of the principles involved in illumination. Not only have they progressively improved light sources and apparatus for controlling and distributing light; they have also paid increasing attention to the effects of lighting upon the operative in which they have had the assistance of ocular experts. At their Lighting Service Bureaux the lamp makers have brought together exhibits which illustrate the results of their research and conduct educational courses open to all who are concerned with the design and installation of lighting systems.

Parallel with these activities, or arising out of them, there has grown up a body of specialists, illuminating engineers, whose knowledge and experience are available to factory owners and those responsible for the erection and planning of factories. Through the Illuminating Engineering Society these engineers have attained a professional status which guarantees to those who consult them a sound and reliable service.

In this issue we publish articles bearing upon various aspects of industrial lighting which we hope will give industrialists some idea of the considerations involved. The general effect of lighting on productivity is dealt with by Mr. H. C. Weston and large-scale lighting is exemplified by the steelworks installation described by Mr. G. W. S. Levey. Dr. H. H. Ballin discusses the use of fluorescent tubes in tall buildings, such as power stations and heavy engineering works, and Mr. J. G. Holmes writes on developments in pressure protected installations.

OIL CIRCUIT BREAKER PERFORMANCE

In an article published in this issue Mr. D. R. Davies writes: " In this country and abroad there are probably thousands of untested oil circuit breakers, the performance of which must be a constant anxiety to those engineers who are responsible for the safety of operators and the maintenance of power supply." The tragic consequences that so often follow the failure of an oil circuit breaker in service is a rather grim reminder of the truth of the author's appraisal. If, therefore, the cross-jet bridge, or indeed any other device, will remove the danger to operators and prevent prolonged interruption of electricity supply, it deserves all the encouragement that the electrical industry can give. We cannot help remarking, however, that while supporting the author's desire to make the old breaker qualify for an A.S.T.A. Certificate there must be many supply undertakings which as an interim precaution would be content to make the breaker safe from structural failure.

STRIKES CONDEMNED

Whatever may be said of some of its constituent bodies, the Trades Union Congress, under the guidance of its General Council, generally exhibits sound sense in industrial matters. At its Brighton conference last week the T.U.C. accepted a resolution moved by Mr. A. Prestwich (Engineer Surveyors' Association) dealing with the subject of strike action. While recognizing that the right to strike must be preserved, the resolution stipulated that all possible steps should be taken to avoid strikes and lock-outs as a means of settling disputes. Mr. Prestwich emphasized, as we have done on many occasions, that strikes and lock-outs injure both the parties concerned and the public; as in modern warfare both victors and vanquished are losers. The General Council accepted the motion, but made it clear that it could not interfers with the existing machinery of negotiation. Congrese also decided to continue its wage-restraint policy although there was a strong endeavour by the Electrical Trades Union to secure its abandonment.

FLOOR WARMING

Electric floor warming installations are not unknown in England but it seems as though much more is being done in this way in Scotland. The latest plan is that of Kirkcaldy Corporation which is to proceed with the erection of a block of 48 all-electric flats, the principal features being a floor warming system (from 3 to 4·85 kW per room) and thermal-storage water heaters. Such an arrangement is feasible only if electricity can be obtained on special terms. In this case the South East Scotland Electricity Board offers an off-peak charge (7 p.m. to 7 a.m.) of 0·7d/kWh and a boost is given between 11.30 a.m. and 3.30 p.m. The service (floor warming and water heating) is expected to cost under 10s a week; there will be in addition electric cooking and electric fires for occasional use but the whole cost should prove quite reasonable and will certainly be comparable with that of other methods. It is to be hoped that other housing authorities will watch this experiment (which is to be extended to five further similar blocks of flats) and that other Electricity Boards will consider encouraging this type of off-peak load by means of appropriate tariffs.

TOWARDS SAFER ROADS

A point of importance brought out at the Conference of the Association of Public Lighting Engineers at Eastbourne this week is that almost forty per cent of road fatalities in this country occur during the hours of darkness when there is considerably less traffic. One reason for this, as Mr. W. Robinson pointed out, is that night time accidents are more severe in the case of all classes of road users. Compared with the three per cent increase in fatalities during the day last year there was a rise of eighteen per cent in the number of people killed at night. It is clear, therefore, that while many factors are concerned in the tragic toll of the roads, the provision of adequate lighting can make one of the greatest and most immediate contributions to its reduction.

RAILWAY ELECTRIFICATION

Since work on the scheme was resumed in 1947 steady progress has been made with the 1,500 V d.c. overhead line electrification of the whole of the railway from Manchester (London Road) to Sheffield (Rotherwood Sidings), together with branches to Manchester (Central) via Fallowfield, Glossop and Wath. This is the first main railway in Great Britain to be electrified for the movement of all classes of traffic and the complete scheme is now almost finished. The penultimate stage was reached this week (14th September) when Sir Brian Robertson, chairman of the British Transport Commission, officiated at the inauguration of the electrically hauled passenger services between Manchester and Sheffield. This means that of a total distance of 68 route miles, only three miles, between Sheffield (Victoria) and Rotherwood Sidings, remain to be electrified and this work is expected to be completed by January next year. The line comprises 300 single track miles of electrified main lines and sidings which, it is estimated, will save some 100,000 tons of coal each year apart from speeding up traffic all round. A detailed description of the complete electrification scheme was published in *Electrical Review*, 8th February, 1952.

RECRUITMENT FOR ENGINEERING

We do not think it incumbent to discuss the question of the shortage of science teachers and technologists again so soon after the publication of our leader and the article on the subject in the *Electrical Review* of 3rd September. But yet another document dealing largely with the subject has just been published and is reported elsewhere in this issue. The document is the seventh annual report of the Advisory Council on Scientific Policy (1953–54) and in the main it supports the contentions expressed in the article and the leader referred to above and the letter from the secretary of the Institution of Electrical Engineers published in our issue of 10th September.

LIGHTING AND PRODUCTIVITY

The Incentive Effects of Good Illumination

By H. C. WESTON, F.I.E.S.*

IT is obvious that any job for which vision is necessary cannot be done with individual maximum efficiency so long as any restriction is imposed on the speed and accuracy with which the operator can gather the visual information he needs. Visual powers are variables depending, within physiological limits, upon conditions of lighting.

The level at which our latent visual capacities can actually operate varies with the stimuli intensities characterizing the field of vision and, so, with the prevailing conditions of lighting. This is so evident from common experience that no one supposes for a moment that productivity in, say, watchmaking would be as good under the conditions of lighting usually available for the coalminer as it would be with much better lighting. But of course it cannot be said that the watchmaker must and will be more productive if given " sufficient and suitable " lighting than he will be under bad conditions: only he *can* be if he wills. Good lighting is permissive but not compulsive of good productivity.

To some extent, however, good lighting is an incentive as well as a direct improver of the functional efficiency of the visual system. By creating adequate visual stimuli it is, so to speak, a " look economizer." If what needs to be seen can in fact be seen confidently at a glance, instead of requiring prolonged or repeated inspection, time is clearly saved as well as visual effort and possibly spoilt work. Thus time and energy are available for additional production.

Spontaneous Reaction

Good lighting also tends to promote increased activity spontaneously, as a physical expression of the feeling of well-being and invigoration which, other circumstances permitting, is commonly promoted by liberal environmental brightness. This psychological effect is so generally experienced that it now seems almost incomprehensible that Victorian industrialists, who must have experienced it themselves, should so often have designed their factories to deny it to their workers.

However, that it can be a significant incentive or incitement to work is sometimes disputed, although the fact was clearly demonstrated by a protracted industrial experiment made in a tile works twenty years ago. Moreover, the disincentive effect of environmental dimness was often apparent during the last war in those blacked-out factories where the distribution of light was confined, as far as possible, to the lower parts of interiors, and the visual field above the working plane was depressingly dark. One heard such workplaces aptly called " dumps "; they bred apathy and irritability.

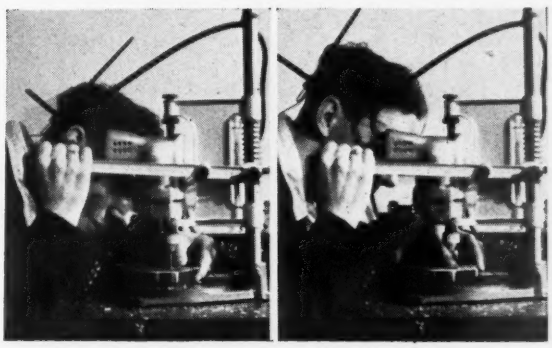
The general responses which tend to be evoked by liberal ambient brightness, namely, cheerfulness, alertness and motor-vivacity, are all in favour of good productivity, whether the kind of work concerned calls only for " casual seeing " or for visual discrimination of the highest order. But the specifically visual responses to lighting must be related to productive capacity in all work that is not, or cannot be, arranged for performance by the blind; and, of course, the finer the work and the less mechanized it is, the more important is the visual factor and the greater the effect that lighting may have upon productivity.

What happens if the lighting is not well matched to the job? Consider first the effect of inadequate illumination. The physiological effect is the limitation of visual acuity to a degree which makes it impossible for the worker to make out the details of his work at a comfortable viewing distance. He has, therefore, to enlarge his visual images to bring them within his restricted resolving power, and this he does by peering at the work. This close viewing increases the muscular effort expended in seeing; all the sixteen intra- and extra-ocular muscles that are working to keep the two eyes focused and oriented for the work are operating too close to their full capacity, and the early onset of fatigue leads involuntarily to relaxations of the gaze of undue frequency or duration.

Fig. 1 illustrates a young man operating a bench drill and shows how viewing distance, and consequently the muscular effort of seeing, is related to the working illumination. The left-hand photo was taken when the illumination on the work was 5 lm/sq ft, whereas it was 3·5 times greater when the right-hand photo was taken. With the lower of these illuminations the operator had on the average to use nearly 80 per cent of his maximum available accommodative power, but with the higher illumination this effort was reduced by 25 per cent and so brought down nearly to the level which, it is generally agreed, should not be regularly exceeded if ocular muscle fatigue is to be avoided. So far as productivity is concerned, the higher illumination resulted in 35 per cent more holes being drilled per unit of time, owing to time saved in visually centring the drill and in " resting " the eyes. As the photographs suggest, there was also not such a " pain in the neck " when the working illumination was 17·5 instead of 5 lm/sq ft.

A working illumination which is insufficient for occu-

Fig. 1.—Comparison of posture and viewing distance of a bench-drill operator at two levels of working illumination: left, 5 lm/sq ft, right, 17·5 lm/sq ft. As these are action photographs taken by flashlight, only the difference in posture is apparent and not the difference in brightness of the work



*Director of the Medical Research Council's Group for Research in Occupational Optics, and Past President of the Illuminating Engineering Society.

Fig. 2.—An unusual and very satisfactory lighting installation. General illumination (15–20 lm/sq ft) is provided by fluorescent artificial windows seen in upper part of the photo. Working illumination (about 100 lm/sq ft) is provided by screened rows of hot cathode fluorescent tubes mounted about 2ft 6in above the benches (Standard Telephones & Cables, Ltd.)

pational seeing to be carried on without a fatiguing posture, and without physiologically uneconomic ocular muscle action, must necessarily prevent productivity from reaching the level that could be attained (*homo volente!*) with sufficient illumination. But here arises the question, how much illumination is required to permit a high level of working efficiency? The answer cannot be a single generally applicable value, for what is required to reveal minute and dark-coloured objects of work greatly exceeds that which suffices to make much lighter and larger objects easily visible. Hence the scale of values which is to be found in scientifically based codes of lighting practice.

The British code, prepared by the Illuminating Engineering Society, is well known and widely followed, and its scale of values rests upon a basis of experimentally determined relations between rates of visual performance, basic characteristics of objects of vision and levels of illumination. These values—which are for high efficiency in performing the actual visual part of any job presenting assessable "details" for discrimination, e.g., the component parts of an assembly, which are measurable as to apparent size, reflectivity and contrast with their background—can be modified for processes or operations where productivity can be influenced by visual efficiency only intermittently and for an aggregate of time which, in some cases, amounts only to a small fraction of the total production time. This modification has been made in the code referred to for a considerable number of scheduled jobs, many of which are, from a visual standpoint, comparable with others not specifically mentioned. The results of actual investigations of the variations of industrial productivity with illumination in some types of work, e.g., type-setting and weaving, have been utilized in deriving these specific recommended levels of illumination.

The effects of age upon individual illumination requirements deserve some consideration, because we have an ageing working population and, in the interest of national productivity, the experience and skill acquired by those of long years of employment should not be offset by failure to meet their increasing light need. Apart from the gradual recession of the near-point of distinct vision, which goes on throughout life and which can be compensated for by "reading" glasses, there are other changes which tend to slow down the rate of visual performance and, to check this decline, stronger illumination of the work is necessary.

Investigation has shown that the speed of visual discrimination of young adults doing variously exacting visual tasks is much less sensitive to variation of illumination, over a wide range, than is that of middle-aged adults doing similar work. In other words, a given increment of illumination conceded to the middle-aged is much more rewarding than it is to the young worker. For example, taking a task comparable in difficulty with reading numbers in a telephone directory, it has been shown experimentally that increasing the illumination on the page, e.g., from 8 lm/sq ft, a value very often not exceeded in practice, to a value sixteen times greater, has a relatively small effect on the speed and accuracy of seeing accomplished by average persons under thirty years of age, but is about four times more effective for persons aged about forty-five years. Although, in this example, the increase of illumination is by a large factor, the increase in cost of lighting may be quite small, for there is no need to get the higher value by general lighting; the needs of older workers can be met economically by supplementary local lights, although care must be taken to avoid excessive brightness contrast between work and surroundings. It may be added that recommended levels of illumination in the code previously mentioned are for average occupational age.

Now let us consider briefly what happens if, instead of sub-optimum illumination, other conditions of lighting are not suitable for the job or are inimical to the worker. Most work-objects are three-dimensional and their visibility will vary according to the directional characteristics of the lighting. Excessive diffusion, or unsuitably placed

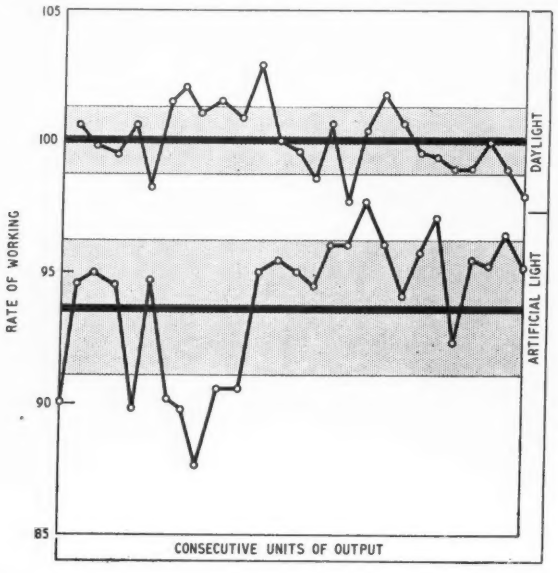


*Fig. 3.—Rate of working of cartridge-case examiners in diffuse daylight (upper graph) and in unsuitably designed artificial lighting causing glitter (lower graph). The width of the shaded bands is proportional to the variability of production rate**

* Plotted from "Inspection Processes in Industry," by S. Wyatt and J. N. Langdon, Rep. No. 63, Indus. Health Research Board, H.M. Stationery Office, London, 1932.

light sources, can lead to insufficient or misleading visual information or to time-consuming movements of the eyes, head, or work-materials to obtain satisfactory views.

Undue diversity of illumination entails time-wasting changes of adaptation of the eyes. Too little diversity can, in some circumstances, induce boredom. The presence of glare may depress productivity, either because workers are made uncomfortable or because seeing the work is more or less impeded. Both effects may be concurrent. Direct glare is caused by over-bright or powerful light sources or areas visible in or close to the field of attention. Too much light reaches the eyes from these sources in proportion to the light received by the eyes from objects they are intended to see. But, dazzling by light reflected from specular surfaces must also be avoided, and this may call for special care in placing light sources and for the choice of sources of low surface brightness. An example of the adverse effect of dazzlement due to indirect glare is afforded by the graphs in Fig. 3. These refer to the productivity of cartridge-case examiners. Using unsuitably designed artificial lighting which made the work glitter, productivity was more erratic and, on the average, 6 per cent lower than it was with diffused daylight.

To conclude this necessarily incomplete consideration of how lighting can affect production, it should be said that the kind of installation likely to give the best results will depend upon the nature of the case; there is not one best method of lighting which is universally applicable. What is important is to assess the requirements as accurately as possible, then plan the installation to meet them.

High Bay Lighting

By H. H. BALLIN, Ph.D., B.Sc.(Econ.), F.I.E.S.*

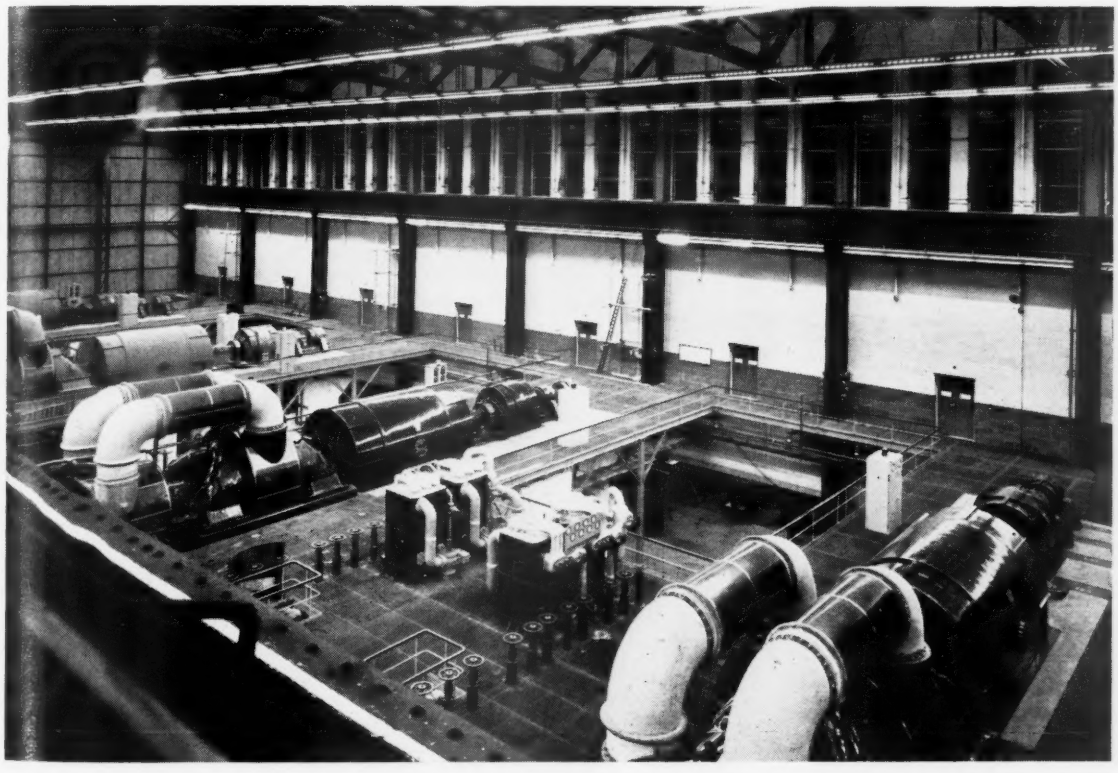
The Use of Fluorescent Tubes

UNTIL recently there appeared to be a natural barrier to the progress of the hot cathode fluorescent tube, so pronounced in the industrial and commercial field, into the realm of high buildings on the grounds that such a low wattage light source could not provide the necessary quantity of light. There have, however, been some very successful fluorescent lighting installations in power stations and other industrial premises which make it desirable that this question should be investigated more fully.

In what ways does the lighting problem in a tall building differ from that of the more common ceiling heights of 15 or 20ft? Resulting from the greater mounting height there is the facility of a substantial increase in the spacing of light fittings whilst still maintaining the correct spacing/height ratios and the use of high wattage lamps. There is at first sight a considerable advantage in the

* Technical Sales Manager, Atlas Lighting Division, Thorn Electrical Industries, Ltd.

High bay installation at Rye House power station



employment of 1,000/1,500 W tungsten lamps, 400 W or 1,000 W high pressure mercury discharge lamps at spacings of 30 to 40ft compared with which the 80 W, or even the 125 W, fluorescent tube seems to lack "punch."

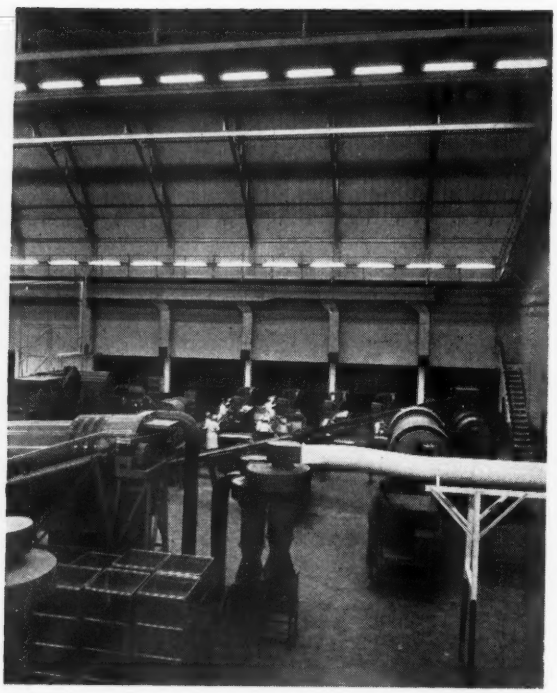
The type of industry particularly requiring tall buildings, heavy engineering, includes a number of processes which necessitate only low illumination (say, 6/10 lm/sq ft) so that the facility of wide spacing can be exploited to the fullest extent. There are, however, a large and growing number of industrial activities calling for high buildings (such as the aircraft industry) where the nature of the work necessitates high levels of illumination. Continuous rows of 2, 3 or 6 fluorescent tubes can provide an illumination of 20 or more lm/sq ft over practically the whole floor area, as is shown by the following details of two recent fluorescent high bay installations.

In Rye House power station at Ware, Herts, the turbine hall is 270ft long by 120ft wide, and 748 5ft 80 W "Atlas White" fluorescent tubes are mounted in 3-tube fittings at a height of 40ft above the turbine floor. The maintained average illumination amounts to 20 lm/sq ft on the turbine floor and 18 lm/sq ft in the basement—65ft below the light sources.

In a tobacco processing factory at Welwyn Garden City, four rows of twin tube fittings were installed with 72 "Atlas Northlight" and 72 "Atlas Natural" tubes, illuminating an area of 90ft by 93ft. The centre rows are at a height of 40ft while the side rows are 25ft above floor level. An average illumination of 16 lm/sq ft is obtained.

Quality of Lighting

Considering that the product under construction is frequently of considerable height and that the work has to be carried out on vertical as well as horizontal planes, a lighting installation with high wattage lamps at considerable spacings has serious disadvantages. For many operations the worker has to rely on the light from a single lamp and will necessarily be inconvenienced by harsh shadows. Further disturbance is caused by travelling cranes and hoists which necessitate the provision of additional fittings on the underside of the cranes and the use of plug-in local lighting.



Installation in a tobacco factory at Welwyn Garden City

The attitude towards such lighting problems may be tougher in heavy engineering than in other industries and what would be intolerable in fine assembly work may be considered no more than a nuisance here, but there can be no doubt that an improvement at a reasonable cost should be welcomed by management and operatives alike. Continuous fluorescent lighting is, in this respect, vastly superior to any other system and would radically transform the working conditions. Owing to the position of the light source far above the normal line of vision no problem of direct glare is likely to arise even from high wattage lamps and the danger of inconvenience from reflected glare may be considered remote.

Colour Rendering

In general the colour and colour rendering properties of the light source may be considered less important in a high bay installation both because of the type of work involved and the preponderance of male operatives. It would, however, be erroneous to assume that colour does not matter at all; and this is shown by the relatively small number of sodium installations, despite the high efficiency of this light source, and by the various steps taken to improve the colour of h.p.m.v. lamps. The so-called fluorescent h.p.m.v. lamp is not entirely satisfactory as yet from the colour rendering point of view in the high wattages—the 80 W and 125 W sizes are unlikely to be used in high bays. Blended systems, however, are being more and more widely adopted where mercury lamps and tungsten lamps are either combined in a single fitting or suspended in individual reflectors from a short piece of trunking.

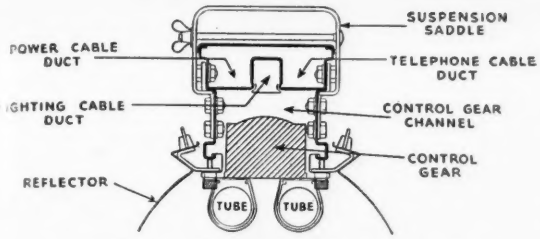
Colour codes are widely employed for distinguishing raw materials, such as metal bars, cables, and on labels for shipping identification, and with the growing complexity of large scale plants the importance of easy and unambiguous recognition of colour will draw works managements increasingly towards light sources with good colour rendering.

If the modern ideas of colour treatment in factories penetrate into heavy engineering and if greater mechanization leads to the increasing use of girl labour, the choice of a light source with good colour rendering properties may become as important here as it is in the lighter industries.

Summing up, it may be stated that with the possible exception of premises where the rough nature of the work calls only for very low levels of illumination, fluorescent lighting has no technical disadvantage but, on the contrary, is superior to discharge lamp installations from the colour angle and in quality to any installation of widely spaced high wattage lamps. This superiority may render the use of fluorescent tubes desirable, in some cases irrespective of cost, and will certainly make this system worthy of consideration if the economics are not too heavily biased against it. The capital and running costs of various systems must now be investigated.

Capital Costs

The initial capital outlay on a discharge lamp installation is generally higher than that for tungsten filament lamps and fluorescent tubes, in turn, are likely to form a more costly installation than discharge lamps. Against this there is, however, the higher luminous efficiency of the fluorescent tube. The initial cost of fluorescent lighting



Cross-section of multi-purpose trunking with two 80 W fluorescent tubes

can be minimized by the use of a multi-purpose overhead trunking system. In such a system the fluorescent control gear is fixed by some easy method to the trunking and the lighting fitting itself need be no more than a simple reflector. The trunking serves purposes additional to lighting and can carry power and communication cables. In this way a proportion of the cost of the trunking could be justifiably booked against the cost of installing other services. The higher the level of illumination required, the cheaper will be the capital cost, as the same trunking system can support two, three or even six tubes in continuous rows.

Running Costs

The running costs of a lighting installation include the amortization of capital charges, the interest on the investment, cost of lamp replacement and electricity consumption, but the labour costs of maintenance and cleaning are additional items which, in the case of high buildings can become very considerable.

In the accompanying table comparative figures have been given for fluorescent, cold cathode, mercury vapour, fluorescent mercury and blended systems and in order to make the figures comparable the cost of providing 1,000 lumens has been worked out in each case.

As the table shows, the hot cathode fluorescent tubes, thanks to their efficiency, have a low electricity consumption and owing to their long life the cost of tube replacement is the lowest although seven 80 W tubes are required for every 1,500 W lamp.

It will be seen that the 1,000 W mercury vapour lamp is the most economical solution, but the difference is so small as to make the use of fluorescent tubes worth very serious consideration for the quality reasons referred to above. Fluorescent tubes are cheaper than 400 W standard or fluorescent mercury and blended installations; 1,500 W tungsten lamps are actually cheaper than 400 W fluorescent mercury, but cold cathode fluorescent tubes work out very much higher.

Maintenance

Owing to the height and general inaccessibility of lighting equipment the maintenance aspect is of very considerable importance in high bay installations. This will favour light sources with a long life and in extreme cases the cold cathode fluorescent tube with its life of over 15,000 hr may be the choice in spite of its high cost.

The labour cost of individual lamp replacement can be very high indeed and accompanied by very considerable inconvenience. If a single high wattage light source is responsible for the illumination of a substantial area its failure will necessitate immediate action. On the other hand, if the relatively low wattage fluorescent tubes are employed, even the failure of more than one tube will not seriously reduce the illumination level and replacement can be left for a time.

At the Rye House power station, for instance, one section of the turbine house has been in operation continuously for over two years and the fluorescent tubes have operated for over 5,000 hr. Only very few tubes have so far failed, but none of these has, as yet, been replaced as group replacement of the whole installation is due to take place in the near future.

Group Replacement of Tubes

The guaranteed average life of 5,000 hr for fluorescent tubes means that 50 per cent of a batch of tubes are

COMPARISON OF COSTS OF PROVIDING 1,000 LUMENS BY MEANS OF VARIOUS LIGHT SOURCES

Ref.	No. of Lamps	Type of Light Source	Lamp life (hr)	Total lumens	Watts per 1,000 lumen lamp output	Lamp costs per million lm-hr	kWh charge per million lm-hr at 1·1d/kWh	Fittings and gear cost per 1,000 lumen lamp output	kWh charge	15% capital amortization	Lamp costs	Total costs
									Annual costs per 1,000 lumens output per 3,000 hour usage			
						£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d
1	6	**5ft 80W fluorescent tubes** using white 3,500 deg K "Quickstart" tubes in two triple tube reflectors on trunking c/w gear	5,000	24,000	24·5	8⅜	2 3	1 13 0½	6 9	4 11½	2 2	13 8½
2	2	**8ft 125W fluorescent tubes** using "New Warm White" "Instant-start" tubes in twin tube industrial type fitting c/w gear	5,000	13,750	20·0	10½	1 10	2 10 0½	5 6	7 4	2 6½	15 4½
3	3	**8ft 6in 70 W cold cathode tubes** using "New Warm White" tubes in triple tube industrial type fitting c/w gear	15,000	7,620	32·8	11½	3 0	4 6 8	9 0	13 0	2 10½	1 4 10½
4	1	**1,000 W h.p. mercury discharge lamp** in industrial type concentrating reflector with control gear housed separately	3,000	50,000	21·1	1 0½	1 11½	13 4	5 10	2 0	3 2½	11 0½
5	1	**400 W h.p. mercury discharge lamp** in industrial type concentrating reflector with control gear housed separately	4,000	14,400	29·2	1 0½	2 8	19 10¾	8 0	2 11½	3 1	14 0¾
6	1	**400W mercury/fluorescent lamp** in industrial type concentrating reflector with control gear housed separately	4,000	12,400	33·9	1 7¾	3 1½	1 3 5	9 3¾	3 6	4 11½	17 3
7	1 1	**400 W mercury discharge lamp** **1,000 W general purpose lamp** using two industrial type concentrating reflectors with gear housed separately	4,000 1,000	14,400 18,350	75·95	11⅞	3 11⅞	11 6½	11 11¼	1 8¾	2 11½	16 7¾
8	1	**1,500 W general purpose lamp** in industrial type concentrating reflector	1,500	29,250	51·2	9½	4 8½	3 0½	14 1	5½	2 3¾	16 10½

(a) "Watts per 1,000 lumens" includes all control gear losses. (b) "Lamp costs" include purchase tax where applicable. (c) All lamp, fittings and gear costs are based on list prices. (d) Fittings cost based on high quality industrial fittings of comparable standard. (e) In order to compare the relative operating costs for fittings of different lumen output the annual costs have been calculated per 1,000 lumen lamp output.

expected to last 5,000 hr and more and that the hours by which the survivors outlast the average is at least equal to the shortfall in performance of tubes failing before 5,000 hr.

Improvements in fluorescent tube quality during the last few years have succeeded in practically eliminating tube mortality during the first 3,500/4,000 hr, after which failures will occur at an increasing rate. In ordinary commercial and industrial installations the labour cost of individual tube replacement has to be weighed against the labour cost of group replacement at a predetermined time—say when the tubes have operated for about 4,500 hr. As this time can be chosen at the convenience of the user and can be combined with the normal cleaning of the lighting fittings, the labour cost may be as little as 3d or 6d per tube, whereas individual haphazard replacements may cost anything up to 9s or 15s per tube. A simple example will demonstrate the economic advantages of group replacement.

In an installation of 100 80 W tubes—

	£	s	d
Assuming the cost of the 80 W tubes (including P.T.) to be		15	0
the labour cost of individual replacement to be		10	0
and the labour cost of group replacement			6

the following situation arises:

(1) Haphazard replacement (assuming average life 5,000 hr)				
100 tubes	at 15s each	75	0	0
100 replacements	at 10s each	50	0	0
		£125	0	0
(2) Group replacement at 4,500 hr (assuming 10 per cent individual replacements before this period)				
110 fluorescent tubes	at 15s each	82	10	0
Individual replacement cost for 10	at 10s each	5	0	0
Group replacement of 100 at 4,500 hr	at 6d each	2	10	0
Total cost every 4,500 hr		£90	0	0
Total cost for 5,000 hr		£100	0	0

The relative labour costs in this example are not, in the author's opinion, unreasonable, but the one factor which may to a certain extent reduce the advantage of group replacement is the possibility that in some installations the average life of the tube may exceed 5,000 hr. Even if we assume that the total cost for individual replacement will have to be borne only every 6,000 hr, the pro rata cost of group replacement for this period still amounts to only £112 10s 0d. Apart from this the regular group replacement has the obvious advantage of higher and more consistent quality of lighting.

High Bay Group Replacement

In a high bay installation the cost of individual lamp replacements is likely to be substantially higher and may necessitate the use of cranes or even the erection of suitable scaffolding. Owing to the large number of fluorescent tubes employed compared with the number of high wattage lamps, maintenance costs of fluorescent tubes would be quite disproportionately high unless a group replacement of tubes were planned. In a high bay installation this scheme would provide that no tubes were replaced until the date of the group replacement arrived.

It must be stressed that such a scheme should not be carried out with the conventional starter switch circuit as with the failure of the tube the switches would repeatedly attempt to strike, causing the destruction of the switches and before long the over-heating of and, possibly, serious damage to the control gear. It would therefore be necessary either to use switches with a special cut-out device, or to install a "quickstart" or "instantstart" circuit.

Conclusions

Unfortunately, information is not readily available regarding the actual maintenance costs of different installations and lighting systems. It is therefore not possible fully to assess such items as cleaning costs for open and closed fittings, but the advantages of fluorescent high bay lighting already established on the grounds of quality of lighting and economy are likely to be reinforced if a system of regular cleaning and group replacement of tubes is adopted. The demand for higher quality lighting in heavy industry can therefore be met economically by the use of fluorescent lighting.

Television Detection

ON Friday last the Postmaster-General, Earl de la Warr, gave an official send-off to nine new television detector cars, which are setting out this month with the object of detecting unlicensed television sets. The equipment fitted in each car utilizes the magnetic induction field set up by the line-scanning coils of the television receiver; this field contains strong harmonics of the fundamental line scanning frequency of 10·125 kc/s and these can be picked up by the sensitive receiver used in the detector equipment at distances of up to 100ft.

Three horizontal loop aerials are employed; these are tuned to the second harmonic (20·25 kc/s) of the line frequency and are mounted on the roof of the detector car in an "L" formation. The outputs of the loops can be switched in turn to the input of the radio receiver and its audio output heard on a loudspeaker or indicated on an audio level meter. By noting the relative levels of the signals from the three loop aerials the operator can obtain a clear indication of the relative position of the television receiver to the detector car. The strength of the magnetic induction field varies inversely as the cube of the distance and this fact enables the operator to discriminate between neighbouring receivers.

G. A. Priechenfried & Associates, electronic engineers, of Ealing, developed the van equipment, both fixed and portable, from a Post Office experimental model, and in addition manufactured and installed it.

Institute of Fuel Conference

AN inaugural conference pertaining to a special study of "sulphur removal and recovery from fuels" convened by the Institute of Fuel will be held in London at the Institution of Mechanical Engineers on 6th and 7th October. Sir John Maud, K.C.B., C.B.E., Permanent Secretary, Ministry of Fuel and Power, will open the Conference at 10.0 a.m. on the first day. Papers to be read during the proceedings include "Social and Industrial Consequences of the Presence of Sulphur in Fuels" by Dr. A. Parker; "Occurrence of Sulphur in British Coal" by Mr. A. M. Wandless; "Sulphur Removal from Fuel Gases by Dry Methods" by Dr. R. H. Griffith; "Sulphur in Coal Gas, and its Removal by Wet Methods" by Dr. S. R. Craxford and Dr. A. Parker.

Full particulars of the conference and registration forms can be obtained from the Institute of Fuel, 18, Devonshire Place, Portland Place, London, W.1.

Lighting in Steelworks

Continuous Production Depends Largely on Artificial Lighting

By G. W. S. LEVEY*

INADEQUATE lighting can be the result of a badly designed installation or lack of maintenance of a good one. Both lead to inefficient production. The capital cost of the installation and the rate of fall in the light output are higher in a steelworks than in most industries and these conditions are largely responsible for poor lighting in older works. Better lighting is found in modern and reconstructed works because it is realized that the complicated plant cannot be effectively operated and served in semi-darkness. More attention has also been given to the reduction of air pollution and to the provision of easy access to lighting fittings, both of which have reduced maintenance costs.

Artificial lighting is obviously necessary where any work is done at night or in areas not having natural lighting; useful work cannot be done in darkness. The effect of the quantity and quality of the illumination is not, however, so readily determined, but the following effects of higher levels of illumination are worth consideration:—

1. The improvement in the speed of vision allows the operators to make quick and accurate observations, which are so vital in a fully mechanized works. In a continuous strip rolling plant the product is sometimes travelling at 70 m.p.h. and there are many meters and indicators to watch.

2. The maintenance of the plant is easier and if a breakdown does occur it can be dealt with expeditiously without the use of temporary lighting. Spoilage through maladjustment of the plant or loss of production during a breakdown can cause a very serious loss in a short time with a highly rated plant.

3. Operative and maintenance staff can move about the plant with confidence, avoid obstructions and other hazards and so reduce the number of accidents, and accidents not only delay production at the time but often affect the morale of the remaining personnel.

4. A well-lit area is good psychologically and tends to improve manual performance. Most people feel more energetic in bright surroundings and enjoy natural lighting, which is generally much higher than the artificial illumination economically maintained in a works.

The rate of production is not directly proportioned to the level of illumination; it would follow the logarithmic relationship found between visual acuity and illumination. There must, therefore, be an economic limit when the cost of providing and maintaining a lighting system balances the gain in production.

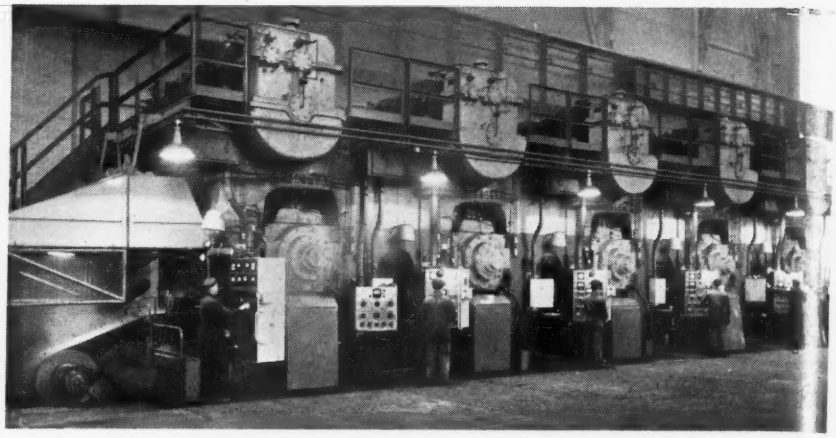
A general illumination of 6 lm/sq ft has been found satisfactory in slab yards, melting shops, soaking pits and similar buildings, increased to 12 lm/sq ft in hot rolling mills and mould preparation bays and 20 lm/sq ft for slab inspection, sheet and plate finishing and cold strip mills. Although these values are modest, they represent 10 per cent of the total works electrical load, and about 10 kWh per ton of steel produced.

Production in a steelworks being continuous depends

* McLellan & Partners

largely on artificial lighting because even where good natural lighting is provided by day, artificial illumination is required for well over 4,500 hours per annum and much of the auxiliary plant is installed below the operating floor where constant illumination is essential.

The cost of installation and maintenance of a lighting system is an important factor in assessing the amount of light to be provided. The less these cost, the higher the balancing point between production and illumination. The dirt-laden and often corrosive atmosphere and high temperatures and the need for robust equipment tend to raise these costs, thus careful design is necessary to keep them low enough to make good lighting an economic possibility.



Supplementary lighting on a five-stand continuous strip cold rolling mill

Maintenance and Illumination

Production is lowered by inadequate maintenance of the lighting system, and the system should, therefore, be designed to facilitate this operation, even if increased capital costs are involved. Lighting fittings in a steelworks lose their efficiency very quickly; it may drop to 50 per cent of the initial value in a few weeks. Safe and easy access for cleaning and suitably designed fittings are important factors. Most steelworks buildings are high and equipped with overhead travelling cranes, the lighting fittings being secured to the roof trusses above the cranes. Lowering and raising gear cannot be used.

Cranes are vital to steelworks processes and when not being used for this purpose are either required for plant maintenance or are out of use for inspection or overhaul. They are not, therefore, available for the regular maintenance of lighting fittings. Moreover, the Electricity (Factories Act) Special Regulations require that "access to lights for renewal or other purposes should be free from danger." Unless special precautions are taken, the use of cranes as a scaffold is not free from danger. Walkways along the trusses form a very convenient access to both lighting fittings and their associated wiring. They also form a satisfactory mounting for distribution and control gear at high level, thereby reducing the length of final sub-circuit wiring, which is more costly than the equivalent main cable.

The high rate of depreciation of lighting can, to some extent, be reduced by selecting fittings to suit the atmospheric conditions in the particular area. For instance, fittings which keep clean because internal convection currents carry dust away from the lamp and reflector are satisfactory in dry, dusty conditions where the air is not unduly disturbed and the lamp is in constant use, but are not so effective where violent air currents from furnaces or hot metal disturb the intended air flow through the fittings or the lamps are used intermittently.

Totally-enclosed fittings are necessary where the atmosphere is corrosive or a sticky form of pollution is present. The cost of lamp changing, however, is higher than with open fittings.

Generally it is desirable to provide fittings which can be easily detached and replaced by clean units so that the dirty ones can be cleaned in the maintenance shop.

Steelworks siding at night illuminated by projectors on two towers

Suitable Controls

Photo-electric control ensures that full use is made of the general lighting, but that it is not wasted where natural lighting is adequate.

If the photo-cells are placed inside the building, the control varies with atmospheric conditions and compensation is made for dirty windows and to some extent for depreciation of lighting fittings. The photo-cell "window" should be cleaned at the same time as the fittings.

It is preferable to install a number of photo-cells fixed in positions where the conditions are similar to those around the lights it controls. The rate of depreciation in large steelworks buildings can vary considerably, depending on the work done in the different sections.

Electricity Supply

An extensive failure of the electricity supply to the power system is usually avoided by arranging alternative supplies to all important plant. A failure on the lighting

system can equally bring production to a standstill and similar arrangements should be made to ensure a continuity of supply to the main distribution boards. This can usually be done by connecting the boards on a ring main between substations. Battery-fed stand-by lighting systems, although necessary in the power station and control centres, can seldom be justified throughout a works.

Supplementary Lighting

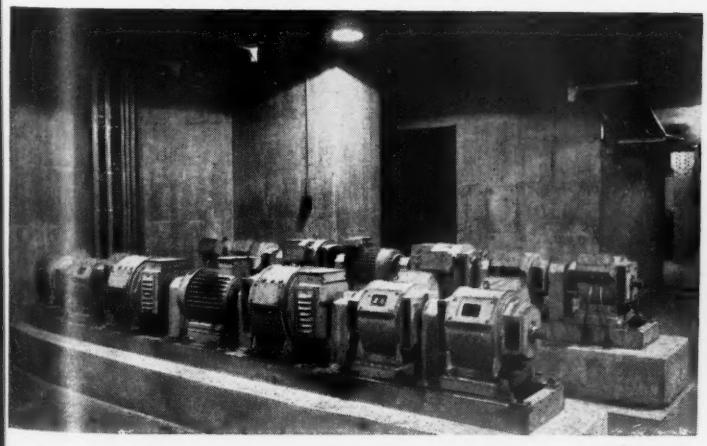
Good general lighting reduces the need for supplementary lighting to that required for inspection, the illumination of instrument panels and to areas where particular attention has to be given to the product.

The inspection and dressing of slabs, which can weigh up to about 12 tons, requires a large area which can be satisfactorily lit by increasing the number of general lighting fittings. But the inspection of bright sheets needs well diffused local lighting without reflections from the general lighting lamps. Large hoods finished matt white on the underside and illuminated by concealed fluorescent tubes shield the area from unwanted reflections and give the sheet a bright white appearance so that faults can be readily seen. As works are mechanized and the rate of production increases, instrument and gauge panels become very important and should be treated as focal points illuminated to a higher value than their surroundings.

The ideal but usually impracticable way of lighting dials is by internal lamps, either lighting an opaque dial indirectly or an opal dial from the back. When lit locally, the fittings should be placed to avoid shadows from the bezels and reflections from the glass to the operator's normal position. Labels should have a matt finish; it is practically impossible to illuminate small polished labels so that the engraving can be seen in any position within the operating area.

Local lighting is useful to supplement the general lighting where shadows are thrown by the plant, as between stands on a continuous mill, or where attention to detail is necessary. It is also advisable to increase the illumination of notices or danger spots to attract attention to them. Glare from the comparatively low light sources should be avoided, both to the operators and others working in the vicinity. The illumination can generally be increased to ten times that of the general lighting, without producing an uncomfortable contrast with the surroundings. Where space is limited and directional light is required, reflector lamps in suitable enclosures are useful; tubular fluorescent lamps, giving a more diffused light over a larger area, are sometimes preferable.

Lighting in a mill basement



The lighting of smaller and infrequently used spaces such as basements, cable tunnels and conveyor passages, is just as important as that of main buildings. Equipment and plant left in darkness is apt to be overlooked until a breakdown has its repercussions on the more obvious production machines.

Good lighting in long conveyor and cable tunnels involves a comparatively high capital cost, which is often considered unnecessary. It is, however, justified because the more thorough inspection which can be done in safety and quicker than when groping about in semi-darkness with a portable lamp, ultimately plays its part in maintaining production.

Control of this class of lighting is important; it should be possible to switch it on or off at convenient points on the normal maintenance route, otherwise it is liable to be left on for long periods when not required. This not only increases the running cost but also leads to a large percentage of burnt-out lamps being left in position or a very high lamp changing cost.

Exterior Lighting

In a steelworks much work is done outside at night, chiefly in connection with the flow of materials, which extends the importance of lighting to these areas. The road traffic is heavy enough to warrant a normal public road class of lighting, especially as the roads are used by pedestrians and there are many rail crossings.

The method of lighting large areas from a number of comparatively low poles has been superseded in modern works by larger light sources on high self-supporting towers. This system eliminates the obstruction caused by a number of poles and provides a more even illumination with less glare. Shadows are also reduced, which simplifies the work of shunters on the sidings.

Steelworks cover such a large area that central control of all external lighting is essential. The switching is best initiated by a photo-cell and transmitted by impulses over the medium voltage supply system to automatic switches connected to sections of the lighting system. Lighting is then on when required but not wasted.

Acknowledgment is due to the General Electric Co., Ltd., and the British Thomson-Houston Co., Ltd., for the loan of the photographs.

Apparatus for Technical Colleges

TO implement plans for the adequate teaching of science in the war-damaged and under-developed regions of the world, the United Nations Educational, Scientific and Cultural Organization (UNESCO) is preparing a series of inventories of apparatus and materials for teaching science at all levels. The fourth part of this work (H.M. Stationery Office, 15s 6d) deals with the training of electrical engineers.

Useful information is given about the arrangements for teaching electricity at the Ecole Supérieure d'Electricité (France), the Royal Technical College, Stockholm, and in Great Britain. Each subdivision describes the general organization of the school and its teaching programme. Then the inventory of instructional material and contents of the courses is given in detail, including lists of apparatus, with the cost of each item in dollars. For the sake of clarity, the lists are related to corresponding curricula. The inventories may also contribute to bringing about equivalence of degrees and diplomas in science and engineering, irrespective of the universities and institutions where they are awarded.

Modern Lighting

A Variety of Installations

LIGHTING installations are now generally planned to meet the special needs of the purposes for which they are to be employed and also to conform to the architectural features of the premises in which they are installed. From many photographs received we have selected the pictures shown on the opposite page as examples of good modern lighting, and in the following notes we give brief particulars of the installations.

At a shoe shop recently opened by John Kavanagh, Ltd., in Kingston-on-Thames, the ground floor interior, devoted mainly to ladies' footwear, is illuminated by "Atlas" 4ft 40 W "daylight" fluorescent tubes in a canopy, giving indirect illumination from the ceiling above and diffuse direct lighting through opal glass on to the seats immediately below. "Forrest Modern" fittings on the canopy edge and over display panels are used as spotlights.

In the men's and children's department in the basement the lighting treatment is similar except that reeded "Perspex" diffusers are used in the canopy. Access is by a staircase illuminated by 3ft 30 W fluorescent tubes concealed within cross beams. Each of the two window cases is illuminated from ceiling mounted fluorescent tubes screened from direct view by detachable anodized aluminium baffles, with spotlights providing accent lighting on selected areas of display. The lighting was planned by Thorn Electrical Industries, Ltd., in collaboration with the architect, Mr. Atkins, and was installed by the South Eastern Electricity Board, Surrey Sub-Area (Kingston and District).

Fittings designed and manufactured by Courtney, Pope (Electrical), Ltd., are installed in the premises of the Australian Mutual Provident Society, Cannon Street, E.C. The fittings are about 2ft 6in square and are suspended on bronze drop rods. Eight 2ft 40 W fluorescent tubes are employed; the contractors were Electricity Services, Ltd.

Lighting employing 8ft 125 W fluorescent tubular lamps is installed in the turbine hall of the Huncoat power station, Accrington. The complete station lighting was designed by Metrovick illuminating engineers in co-operation with the consulting engineers, Messrs. Kennedy & Donkin. The turbine hall is fitted with twin lamp industrial troughs mounted 40ft above floor level to provide an average service illumination of 12–14 lumens/sq ft.

The Walpamur Co., Ltd., has installed Revo "Trufolite" reflector fittings for the illumination of its factory at Darwen. In the stock room and forwarding department 350 of these lighting units have been installed.

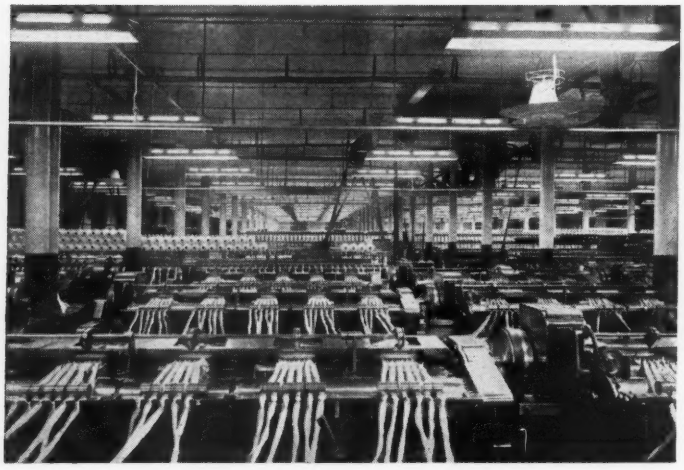
Sedgwick Collins & Co., Ltd., insurance brokers, have installed "Mazda" 5ft "Perspex" fluorescent diffuser lighting fittings in one of the large offices which they have recently taken over at Regis House, King William Street, London. More than 100 of these fittings have been used to give over 30 lumens/sq ft on the working plane. The electrical contractors were Electrical Installations, Ltd.

A new self-service food store recently opened by John Gardner (London), Ltd., at Sutton, Surrey, is illuminated by Philips "Ardingley" fittings, incorporating the special Philips tungsten ballast lamp which, used in combination with the Philips MCFB/U fluorescent lamp, provides an installation in keeping with this store.

The church of St. George, Stockport, has a new lighting system which has been planned to enhance the church's architectural features. Special 5ft fluorescent fittings, coloured to match the stonework, were designed by the General Electric Co., Ltd., and concealed in the column flutings. In addition 200 W "Gecoray" floodlights were hidden in the roofs of the side aisles and focused on the pew seats near the outside walls. In the choir and chancel mixed lighting from fluorescent tubes and floodlights picks out the fine wood carving of the choir stalls and the reredos. All the fluorescent fittings used are equipped with "Osram" warm-white instant-start tubes. The floodlights have 200 W and 500 W lamps. Auxiliary gear has been fitted on a concealed ledge running below the clerestory windows and connected to the fittings by lead-covered wiring. The contractors for the installation work were John Hunter & Co., Ltd., Liverpool.

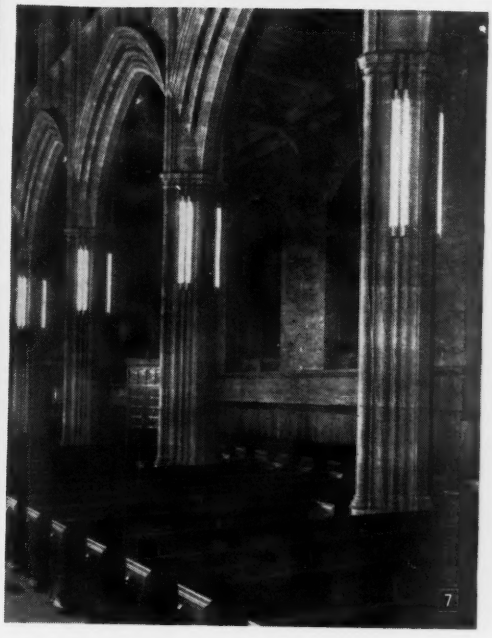
When modern automatic or semi-automatic machinery is used, the settings of the machines for production and the supervision of the production processes depend ultimately upon the human eye observing detail quickly and with ease. The textile industry presents many instances of these applied principles, an outstanding example being at India Mills (Darwen), Ltd., where, in addition to the normal problems of spinning, are the complexities of handling coloured rayon yarns and dope-dyed fibres. Recently the mills' own engineering staff has installed a modern lighting system to the layouts designed by Crompton Parkinson, Ltd. The system, which employs more than 1,400 Crompton 5ft "daylight" fluorescent tubes in Crompton industrial reflector fittings, is arranged to give general lighting over the whole area, with particular attention paid to vertical and horizontal illumination values on the machines and yarn. This lighting scheme, covering over 30,000 sq ft, is wired with Crompton cables, and the electric power is provided by two Crompton Parkinson 90 kW alternators driven from the existing steam engine.

Fluorescent lighting installed at India Mills (Darwen), Ltd.



Examples of Modern Lighting Installations

1. *Australian Mutual Provident Society, Cannon Street, London.* **2.** *John Kavanagh, Ltd., Kingston-on-Thames.* **3.** *Huncoat (Accrington) power station.* **4.** *Sedgwick Collins & Co., Ltd., King William Street, London.* **5.** *John Gardner (London), Ltd., Sutton.* **6.** *Walpamur Co., Ltd., Darwen.* **7.** *Church of St. George, Stockport*



LIGHTING— THE EXPLOSION HAZARD

By J. G. HOLMES, A.R.C.S., B.Sc., D.I.C.*

Developments in Pressure-Protected Lighting Fittings

Improved lighting in hazardous situations is being provided by pressure-protected installations which are coming into use where no certified flameproof fitting is available. This article shows how the rate of pressure leakage may be controlled and easily measured, and suggests that fittings intended for pressure-protection may also be used with advantage in dusty and corrosive atmospheres

Flameproof well-glass pendant (not gasketed)

IN installations concerned with acetylene, carbon disulphide and hydrogen gas, pressurized lighting systems have recently been used because there are no "flameproof" fittings officially certified for these gases, listed in Group IV in B.S. 229 : 1946—"Flameproof Enclosure of Electrical Apparatus." The principle is to protect the lighting fittings and the supply lines from the ingress of an explosive gas by maintaining an excess air pressure within them and to provide a pressure-sensitive relay which will isolate the whole system if the protecting pressure falls below some minimum value. An inert gas such as carbon dioxide may be used instead of air, but the same principles apply. Such systems are straightforward in most respects, although there is some debate as to whether a high pressure of about 5 lb/sq in or a low pressure of about 3 oz/sq in (6in water gauge) should be used. The low pressures are adequate if they can be maintained at all points of the system, and they have the great advantage of cheapness.

There is also some debate as to whether the fittings and supply lines should be made completely air-tight, or whether it is desirable to maintain a slow flow of clean air through the system from the compressor, situated in hazard-free air, to the fittings installed in the danger area. If an air flow is permitted, it should not be large for economic reasons, and it is, perhaps, fair to say that a leakage of 20 cu ft/hr from each fitting would be excessive. A more reasonable figure is 5 cu ft/hr, which presents few difficulties in a well designed fitting subject to a pressure of 6in water gauge.

Provided the leakage rate is sufficient to sweep away any accidental contamination in the system, there are considerable advantages in avoiding a high rate of air flow. Firstly, compressed air causes serious condensation and corrosion if it is not properly dried and filtered, and reduction of the flow will reduce corrosion for a given outlay in drying equipment. Secondly, the time intervals associated with failure in the installation are on the side of safety; an accidental leak will cause a more rapid response of the pressure-sensitive relays or isolating switches, while a failure of the pressure supply will not cause such a rapid fall in the excess pressure in the system.

One of the principal objections to a pressurized lighting system is the instantaneous black-out caused by a fault anywhere in the installation. A warning system is only possible if the leakage rate is small enough to permit a reasonable time interval between the pressure at which a signal is given and the pressure at which protection ceases.

Mathematical Analysis

The flow of air through pipes and through small leaks in enclosed fittings is more complex than the usual law of flow through an orifice in which the rate of flow is proportional to the square root of the pressure, and a different approach may be made. It is an experimental fact that the excess pressure in an enclosed fitting decreases exponentially with time, owing to leakage when the air supply is cut off, and this may be expressed in mathematical terms as follows: $p = p_o\, e^{-kt}$ where p_o is the initial pressure, p is the actual pressure at time t, and k is a constant proportional to the leakage rate.

This means that the time taken for the excess pressure to fall to half its initial value is substantially constant for a given leakage rate and is independent of the actual value of the excess pressure. This time interval is easily determined experimentally and then the leakage rate in cu ft/hr can be calculated from the following empirical formula:

$$\text{Leakage rate (cu ft/hr)} = \frac{\text{pressure (inches)} \times \text{internal volume (cu ft)}}{10 \times \text{half-pressure time interval (min)}}$$

The value of the constant 10 in the above formula has also been checked by calculation from theoretical considerations to within a few per cent.

The same experimental technique can be used for positive or negative excess pressures and the measurements of the half-pressure time interval can be used to calculate the rate of change of the air within the fitting, as follows:

$$\text{No. of changes per hr} = \frac{\text{Excess pressure (inches)}}{10 \times \text{half-pressure time interval (min)}}$$

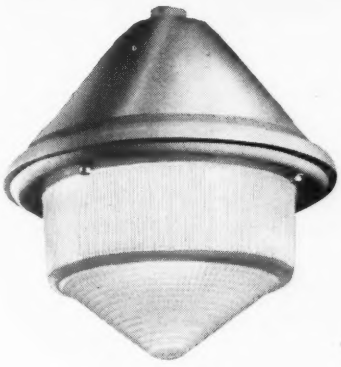
For the particular case of a 6in pressure supply, the number of air changes within the fitting per hour is given by:

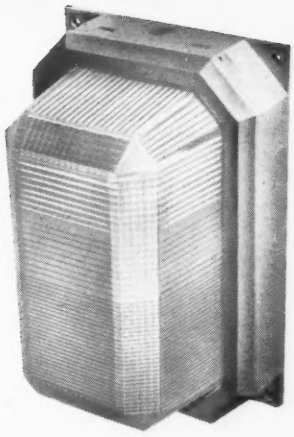
$$\frac{1}{100 \times \text{half-pressure time interval (hours)}}$$

If the half-pressure time is 36 sec, which is a good value for a well constructed fitting, there would be one change of air per hour and the leakage rate per hour would, of course, be numerically equal to the volume of the fitting in cubic feet.

In some installations, standard flameproof fittings have been used because of their mechanical robustness, their

* Holophane, Ltd.





Left: Enclosed circular pendant (tubular rubber gasket and sealed clamping screws) Right: Enclosed rectangular bulkhead (with gasket)

limited temperature rise and the partial protection given even if the pressure fails. B.S. 229 permits a gap up to 0·008in for Group III gases and there may, of course, be a very large leakage of air through such a gap, specially if high pressures are used. Many fittings, however, have gaps of less than 0·002in and a path length from inside to outside of at least an inch, and the leakage rate in a well-made fitting may be of the order of 1 cu ft/hr for 6in excess pressure. This is not unreasonable and therefore it is not usually necessary to fit gaskets. It should, however, be noted that flameproof fittings all have a separate terminal chamber and that the partition between this chamber and the body of the fitting must be pierced if the air supply comes through the conduit itself. This renders the fitting non-flameproof in the terms of the British Standard, but it is a necessary precaution in a pressurized fitting because the terminal bushings themselves may be virtually air-tight.

It is more usual to employ a separate supply pipe of corrosion-resisting metal for the compressed air, direct into the lamp compartment, and to allow the air to pass into the terminal compartment. If conduit is used for the wiring, it must be of good quality and workmanship to avoid rapid leakages, and stopper boxes are generally used at the limits of the danger area.

Some enclosed industrial fittings are quite satisfactory in respect of mechanical construction and temperature rise, but they vary widely in the leakage rate. This variation is due to differences in construction and in the fit of the gaskets which may not matter in ordinary installations. There may, for example, be quite serious leakage at the point of entry of the conduit or at a grub screw or clamping screw which is a poor fit. A little grease or red lead at the time of installation will seal such leaks. Washers under the heads of clamping screws are only satisfactory if the metal surface on which they bed is flat and free from burrs or particles of dirt. Although brute force on clamping screws, etc., can often reduce leakage rate, the same result can be achieved more permanently by good design and choice of materials.

Gaskets are also a source of wide variations in the properties of fittings. Felt and some forms of sponge material are porous, although they may be dust-tight in the ordinary sense, and joints or non-uniformity in the gaskets may cause leakage. It is general practice to employ tubular or solid heat-resisting rubber or rubber-like plastics.

The glass has to be set in some material which will allow for differential expansion of the metal parts of the fitting, and it is common practice to use putty. It should, however, be noted that putty may take a long time to harden and it may become porous if the glass is disturbed even slightly before the putty is reasonably hard. Plaster is often used in flameproof fittings but this will not yield sufficiently to accommodate a large amount of differential expansion and, moreover, a fine crack can easily be formed in it if the glass receives a hard knock. It is probably best to bed the glass in some non-setting mastic or adhesive material, and to retain the glass by metal keepers.

With precautions such as are indicated above, it is relatively easy to achieve a half-pressure time interval of the order of a minute and to reduce the leakage rate to something of the order of 0·1 cu ft/hr for average fittings. This performance can be maintained in service if reasonable care is taken in cleaning and re-lamping.

The table shows the leakage rates obtained in measurements on some typical fittings illustrated.

Fitting	Internal volume (cu ft)	Half-pressure time interval (sec)	Leakage rate (cu ft hr) for 6in excess pressure
Flameproof pendant without gaskets:			
0·008in gap...	0·12	0·5	350
Standard fitting	0·12	11	0·4
Rectangular bulkhead with gasket:			
Standard	0·10	3	1·2
Modified	0·10	25	0·14
Enclosed pendant with gasket:			
Standard	0·19	10	0·68
Modified	0·19	300	0·02

Vapour-proof and Dust-tight Fittings

Pressurized fittings can be regarded as both vapour-proof and dust-tight. If the precautions mentioned are taken and the half-pressure time interval is something over half a minute, the fittings can be regarded as dust-tight without the need for any excess pressure.

The vapour-proof qualities of non-pressurized fittings depend largely on the freedom to breathe through the supply conduit because there is generally a much easier path for air through the conduit than past the gaskets in the fitting. If the conduit and fitting are truly sealed, the excess pressure may build up to several lb per sq in owing to the heating effect of the lamp; in normal circumstances some air will breathe out and will be replaced by vapours from the surrounding atmosphere when the fitting cools, so that eventually the atmosphere inside the fitting will have much the same composition as the average surrounding atmosphere. The process is slow but, with long periods of heating and cooling, no fitting which breathes into the surrounding atmosphere is vapour-proof.

If the fitting can breathe readily through the conduit to clean air, fittings such as described above will not breathe into the surrounding atmosphere. The resistance of the gaskets is likely to be hundreds of times that of the resistance to air flow through the conduit, and a lighting fitting with a half-pressure time interval of more than 5 sec is likely to breathe probably 99 per cent through the conduit.

The technique of measuring the half-pressure time interval is a useful check on the construction and assembly of dust-tight and of vapour-proof fittings because any gap which is large enough to affect the performance of the fitting in conditions of dust or vapour will be readily detected by pressure leakage.

Industrial Engineering

Team's Recommendations Following U.S. Visit

THE last of the reports of British productivity teams to visit America is concerned with industrial engineering, a term that is defined as " The application of basic scientific and engineering knowledge and certain analytical techniques to the methods of operating an organization in industry and other appropriate fields." The report distinguishes the industrial engineer from the production engineer, who is a specialist in his own field while the industrial engineer is " concerned with so many technologies that he cannot expect to know them all. His job is to bring together the scientists, technologists and others in order to promote productive efficiency."

The members of the team were nominated by the D.S.I.R., the Ministry of Education, employers' and trade union organizations and professional institutions. With Mr. W. F. Garnham (Ransomes, Sims & Jefferies) as leader they included Messrs. J. H. Cribb (B.T.H.), N. A. Hare (Joseph Lucas), W. M. Rodgers (D.S.I.R.), H. Rothwell (Brookhirst Switchgear) and E. W. Workman (Morgan Crucible Co.). The terms of reference were " to investigate the dynamic and aggressive American approach to the improvement of methods of manufacture and to the continuous reduction of operating costs."

In considering the reasons for American industry's high productiveness the team places competitiveness foremost among the " transferable " characteristics, i.e., those that could be adopted in Great Britain. More than any other factor, competition provides the drive for the more frequent analysis of costs and the application of industrial engineering techniques, and the constant effort to achieve the most economic usage of men, materials, machines and money. The opinion is expressed that anti-trust legislation in America stimulates competition and it is considered that monopolies legislation in Great Britain should be strengthened and extended.

As a first step it is recommended that Parliament should consider enforcing trade and industrial associations, and trade unions, to publish any rules or agreements that bind their members. Facilities available to small firms for obtaining finance for capital investment should be more widely publicized. Greater encouragement should be given to new investment by revision of the depreciation tax allowance and a more liberal import licensing policy in respect of equipment not available in this country but essential to increased productivity.

Importance of Shift Work

Dealing with industrial methods, the report says that the importance of shift work needs to be realized if expensive machinery is to be economically used; far more industries than at present could with advantage operate shifts. More small firms should be encouraged to specialize in certain products or components to obtain longer runs. The drive from senior management in America is something that should be developed here.

The main body of the report is a series of chapters on the techniques and functions which either come within the scope of industrial engineering or closely affect its practice, followed by others on human factors with which the industrial engineer is vitally concerned. What impressed the team most was the extremely full and detailed discussion given to any project at the planning stage by round-table conferences.

The influence of costing and financial control is fundamental in the American conception of industrial engineering. The team, like others, calls attention to the prompt issue of cost and performance figures and recommends their fuller use. Fascinated by the prospects of high-speed electronic computing equipment, the team urges consideration of its best use.

Tools and fixtures are discussed as well as design, standardization and quality control. Most factories seen were built on functional lines to suit their production, a great deal of time being spent on planning their layout. Good materials handling is not merely a question of suitable equipment; it is a matter of the analytical approach to handling problems.

Among the " analytical techniques " referred to in the team's definition of industrial engineering is what is known as " work study " in Britain and " methods engineering " or " work simplification " in America. Nothing novel was found but the team was impressed by the universal application of time study. Particular attention is drawn to the special advantages of predetermined motion-time systems in planning and their general value is discussed.

The space given to human factors emphasizes the importance attached to this aspect. The team reports on various types of incentives encountered. Managements should recognize that discharges resulting from technical improvements can very frequently be avoided by advance planning to ensure the absorption of the surplus labour force.

Reporting on methods adopted in the U.S. to ensure that managerial leadership is of high quality—particularly annual merit rating of staff and periodical appraisal of the progress of executives—the team recommends greater responsibility and authority for foremen and the adoption of the American practice of managerial co-ordination by means of frequent informal committees. All industrial engineering techniques should be grouped under one executive. Education of the industrial engineer is given special consideration. Five methods of U.S. entry into industrial engineering are distinguished and illustrated by a chart. The team recommends expansion of the educational facilities offered in industrial engineering in Britain. The British Standards Institution should set up a committee to cover the terminology of the whole field of industrial engineering. A supplementary report on education is addressed specifically to teachers and educationists.

The team found that American trade unions are more exacting in wage demands than the British, thus forcing management into constantly improving its methods of production. For American trade unionists " increasing productivity means increasing the wage packet; that is why workers are keen on it." Recently a new type of clause has been included in wage agreements to guarantee annual wage increases related to the expected annual increase in productivity of the whole U.S. economy. The team was impressed by the common use of the " seminar," a study-group technique, where some 15 to 20 persons meet under the guidance of a discussion leader to exchange experience on a particular topic. Closer contact between industry and the technical and industrial Press should be encouraged by means of conferences.

Copies of " Industrial Engineering " are obtainable, price 5s post free, excluding air mail, from the British Productivity Council, 21, Tothill Street, London, S.W.1.

Oil Shale Investigation

THE New Brunswick Provincial Government has decided to employ a New York consulting firm to make a comprehensive study of a proposal of the Nashwaak Corporation of Montreal to burn oil shale to produce heat for the generation of electric power. It is proposed to do this by crushing the shale and feeding it to a combustion unit.

STREET LIGHTING PROBLEMS

Eastbourne Conference of the Association of Public Lighting Engineers

THE annual conference of the Association of Public Lighting Engineers opened at Eastbourne on Tuesday, when Mr. L. A. Doxey (Lighting Engineer, Leeds) delivered his inaugural address with safety on the roads as its main theme. Since 1945, he said, the number of motor vehicles in use in Great Britain had risen from 3·5 millions to over 5 millions—the greatest number per mile in the world—during which period 51,000 people had been killed on the roads and 1,730,000 injured. Almost 40 per cent of the fatalities occurred during darkness (42 per cent of the hours), when there was little vehicular and pedestrian traffic.

Mr. L. A. Doxey

No greater contribution could be made to road safety by night than by a high standard of street lighting. The main obstacle to improvement was not technical but financial. Grants under the Trunk Roads Act of 1936 were applicable to only 5 per cent of the total mileage; the responsibility for the remainder, which included many miles of congested traffic routes, was vested in local authorities, and was in many cases beyond their financial resources.

Apart from this consideration, the first step was to engage competent lighting engineers. Authorities which were unable to engage a full-time official should seek the expert assistance of the Electricity and Gas Boards or the manufacturers of lighting equipment. Co-operation was called for between the lighting engineer, responsible for the type of light distribution, and the engineer responsible for the construction of the roads in regard to the light-reflective surplus of road dressing. Materials used for subsequent resurfacing or patching should maintain the same reflection characteristics as the original material, otherwise night time visibility might be very considerably reduced. Demarcation between the road and footway or verge should be well defined by the lighting. In the planting of trees allowance should be made so that their growth should not cause interference between lanterns and road surface.

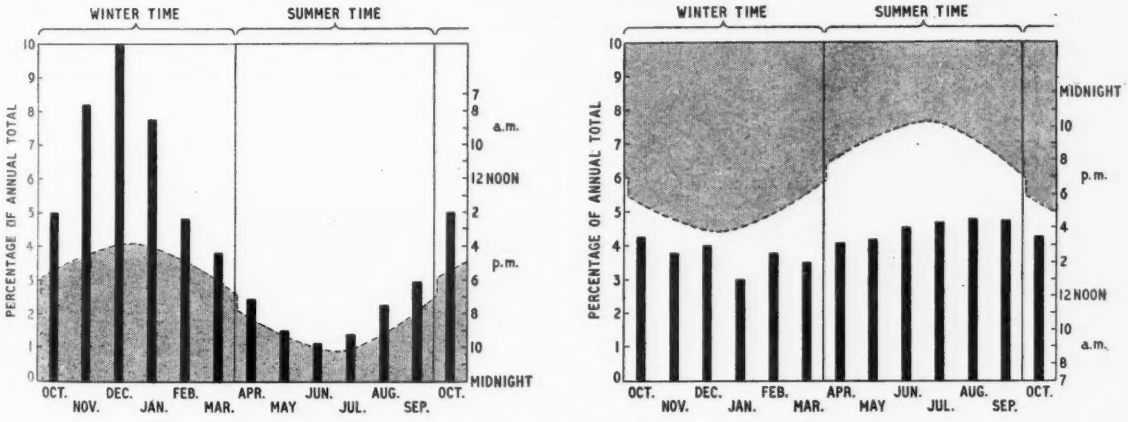
The remainder of the address dealt with the progress made by the Association since its foundation 30 years ago, including a reference to the institution of the Public Lighting Diploma scheme.

On the same day a paper was presented by Mr. W. Robinson (E.D.A.), who dealt specifically with street lighting and road safety. The basis selected was the use of existing statistical data to furnish quantitative information about the real value of street lighting and its place among the factors affecting road safety. The significant period for road accidents, he pointed out, was from 7 a.m. to midnight, divided into 1,600 hr of night road usage (i.e., after lighting-up time) and 4,600 hr of day road usage, giving a ratio of 1 : 2·9. Night accidents were much more severe for all classes. The study was confined to accidents to adults, since children were mainly road users by day.

The ratio of night–day accidents varied from 1·6 : 1 for adult pedestrians to 0·7 : 1 for adult pedal cyclists. The average risk of fatality by night was calculated to be three times that by day, of serious injury twice and of slight injury one-and-a-half times. Day fatalities were shown to reach a fairly constant monthly level irrespective of daylight duration, whereas night fatalities followed the curve of darkness, the total monthly fatalities reaching their peak in the three darkest months.

During these months the hours of darkness and the traffic conditions most closely approached those of daylight. The night–day casualty ratios for all road users in November, December and January, 1952–53, were deaths 2·7 to 1, serious injury 2 to 1 and slight injury 1·4 to 1. Bad weather after dark increased accident risk more than in daylight; the main cause was shown to be reduced visibility. Some Group "A" lighting installations were inadequate because of: over-emphasis on maximum road brightness and under-emphasis on uniformity of brightness which led to dangerous patchiness; maladjustment or faulty choice of lantern leading to glare and diminution of visibility; poor performance on wet roads; and faulty siting of columns.

Administrative and economic factors which operated against the early realization of a national street lighting programme were the continued application of Defence Regulation 56A to street lighting with its associated



Average adult pedestrian road deaths during 1945–52: left, by night; right, by day

restriction of capital and the lack of co-ordination between national and local view-points. A national policy for traffic route lighting, which need not conflict with local autonomy, was required. Such a policy should meet Group A standards on all traffic routes, light trunk roads where appropriate and integrate the lighting of main roads from end to end through the exercise of co-ordinating functions. Traffic was now attracted from ill-lighted to better-lighted roads resulting in congestion and likelihood of accidents.

Some unusual uses of fluorescent tubes for lighting streets where conventional installations were not altogether suitable were described by Mr. B. C. Ossitt (South Eastern Electricity Board) on 16th September. The usual installation, he said, consisting of concrete or steel columns supporting lanterns containing two to seven tubes, gave even road brightness, good revealing power, low brightness with little or no glare, good colour rendering and probably better visibility in wet weather than any other light source. It might, however, be open to criticism in regard to its appearance by daylight when most often seen.

In many towns with narrow streets and buildings of irregular frontage and with a congestion of services below the pavements, the use of columns presented difficulties and called for unusual installations. These were broadly divisible into four groups: tubes arranged vertically on columns at the side or centre of the road; tubes arranged at an angle, as now used in Group "B" installations at 15ft mounting height having totally enclosed lanterns to contain two 2ft 40 W lamps; wall-mounted lanterns with horizontal tubes parallel to the road axis; wall-mounted lanterns with vertical tubes. Examples of each type were described and illustrated and some particulars of comparative costs were given. Both in efficiency and in colour rendering there was more scope for development in the fluorescent tube than in any other light source. The author in conclusion expressed the hope that each installation would in future be planned to suit particular streets, including the provision of lanterns housed in niches in building faces or of lanterns—some directed to light the roadway and some the footpath—housed in the edges of cantilevered canopies outside the buildings.

Control Design and Performance

In another paper on the same day, Mr. A. J. Ogle (North Eastern Electricity Board) brought together data relating to the design and performance of more common forms of electric street lighting control. As an example of economy effected by conversion from individual hand switching (900 lamps) to remote control, he stated that less than two-thirds of the annual costs of the former had sufficed to cover interest (3 per cent) and redemption charges spread over ten years of a d.c. impulse system.

Particulars were given of average annual costs per lamp (including capital charges) and of advantages and disadvantages of various systems. That most generally used relied on time switches, which were divided into four classes, viz., escapement-controlled hand and electrically wound, frequency-controlled and driven by synchronous motors with and without spring-driven escapement-controlled mechanisms to provide against interruption of electricity supply. Group control of, say, 25 lamps by time switch required a switch wire in an underground cable or a copper switch wire, bare or insulated, on an overhead line. For control by light-sensitive switches the group taken had 15 lamps. The use of remote control by a.c. or d.c. impulses was regarded as economically justifiable (owing to the cost of injection equipment) only if a sufficient number of lamps were controlled; comparative costs were based in each case on 100 lamps per low voltage circuit. Control by impulse injection into high-voltage networks (which was discussed) was likely to cost more still. Such centralized schemes became more attractive if used in conjunction with load control (e.g., storage water heating or background space heating), but usually, taking into account installation and maintenance, there was a strong case for controlling lamps in groups fed from a low-voltage main incorporating a public lighting switch wire. In general, however, individual lamp control by time switches, which was not subject to economic restriction on the number of lamps, provided a cheap, effective and reliable method.

Farm Electrification

SOME sixty members of the staffs of the Midlands, the South Wales, and the South Western Electricity Boards are to attend a three-day course on farm electrification to be held at Bristol on 21st, 22nd and 23rd September. The course, which is the first of its kind, has been organized by the British Electrical Development Association, and it will be held in the University of Bristol's Wills Hall Hostel.

With the greatly accelerated rate of rural electrification development, the need has arisen for more staff capable of understanding and dealing with rural problems. The existing agricultural specialists have been supplemented by the transfer of Board personnel to rural development work. At this course these men who have to deal with electrical development of the farm and in the houses of the farmer and the farm worker, will receive oral instruction from experts in various spheres, and they will also be given facilities for group study and discussions on the talks and demonstrations.

The course will be opened by Mr. S. F. Steward, chairman of the South Western Electricity Board, who is also chairman of the E.D.A. Council. He will be followed by Mr. R. A. Bayetto, rural electrification officer of E.D.A., who will speak on "Rural Electrification" and the aims and objects of the course. A lecture on "Agriculture and Good Husbandry" will be given by Mr. S. R. Wragg, of the Economics Department of the University of Bristol and the economics liaison officer of the National Agricultural Advisory Service for the South Western Province. After these three preliminary addresses the students will settle down to hear, in private, a series of papers, discussions and study periods on agricultural problems. The remainder of Tuesday's proceedings takes the form of lectures on "Lighting the Farm" by Mr. W. Robinson, lighting officer of E.D.A., and on "The Importance of Sales Contacts" by Mr. W. J. Guscott, assistant chief commercial officer, South Western Electricity Board, Bristol.

On Wednesday morning "Electricity in the Dairy" will be the subject of a talk by Mr. M. M. Harvey, agricultural officer, Midlands Electricity Board, Birmingham. This will be followed by a study period. In the afternoon Mr. J. T. Taylor, agricultural development engineer, British Thomson-Houston Co., Ltd., Rugby, will lecture on "Electricity for Power Applications." Study groups will then deal with the problem of changing over the machinery on a specified farm to electric drive and will be asked to formulate any rearrangements of layout and farming routine which would effect further economies for the farmer.

Thursday's session will begin with a lecture on "Electricity for Crop Conservation" by Mr. P. G. Finn-Kelcey, a member of the Electrical Research Association's station, at Shinfield, Reading. He will deal with the electric drying of grain, grass and hay and his paper will be followed by a study period. In the afternoon "Pigs and Poultry" will be the subject of a lecture by Mr. W. W. Robinson, agricultural officer for the Western Sub-Area, South Wales Electricity Board, Tenby.

Lamp Publicity

Dealers' Sales Aids

"THE biggest Press advertising campaign for Crompton electric lamps since the war" is how Crompton Parkinson, Ltd., describe their autumn campaign. Advertisements will be appearing in the national dailies, weekly magazines and home interest journals. The slogan for the year is "Don't say 'Lamps'—say 'Crompton.'" Supporting the Press advertising, there will be a wide variety of point-of-sale display material and literature available. Of particular note is a new type of flashing sign, ingeniously contrived to give a "before and after" effect in colour. The messages and humorous pictures employed can be changed readily.

There will also be a mobile display, cut-out showcards, price catalogues, counter leaflets for retailers, and price cards. A new simplified and more modern looking version of the Crompton carton has been designed.

"Silverlight" lamps have been chosen to form the principal item of display advertising in the campaign for "Metrovick" lamps by the Metropolitan-Vickers Electrical Co., Ltd. An attractive cut-out is available, printed in ten colours (30in by 24in) showing a small boy exhorting his father to "Stick 'em up, Dad, Everywhere!" This theme is also used on a showcard (19in by 13in) and bulk supplies of small counter leaflets giving prices are available for use with these displays. Trade and technical Press advertising will link up with these displays. In addition a general purpose lamp unit is available attractively coloured with three extending panels to form a window background. The overall size of the back panel is 4ft square and the smaller panels extend approximately 4ft. These displays are largely self-contained, without the need for additional packing cases. New publications for the lighting season include a fresh edition of the lamp catalogue. The revised easy reference layout adopted last season has been further improved. A handy pin-up folder is available with quick reference details of prices and purchase tax covering general service, fluorescent and automobile lamps. Other publications include a new edition of the broadsheet giving comprehensive details of the standard range of fluorescent fittings. A revised street-lighting catalogue and commercial lighting fittings catalogue are also due to appear almost immediately.

The material available from Siemens Electric Lamps & Supplies, Ltd., includes new point-of-sale aids and special showroom exhibition pieces. A window dressing service is also available. Of special appeal are a table lamp cut-out for the counter and an attractive three-colour permanent transfer for window mounting. One of a number of attractive display centre-pieces consists of a curved panel suitable for a window or showroom floor, which illustrates the types of lamps appropriate for indoor use.

For garages, service stations and motor accessory factors, a new display has been produced which is available either as a cut-out or as a wall-mounting poster. "New Horizons for your Car Lamps" is the theme of this display piece.

A "Mazda" display unit which can be used independently or as the central feature of a "Lighting to Measure" window dressing

A specially designed display showing good domestic lighting is available for large windows and showrooms. It consists of one, two or three separate panels which can be utilized separately or as a combined whole. A new four-colour pocket-size catalogue has been produced. The campaign will be backed by local Press advertisements, while special-purpose lamps will be advertised in appropriate journals.

The campaign of the British Thomson-Houston Co., Ltd., will include half-page advertisements in papers such as *The Times* and *Manchester Guardian*. They will be similar in style to those of last year, being based on photographs and including short descriptions of some of the more interesting ways in which the company has contributed towards important lighting developments during the last fifty years or so. Publicity in the national papers will also include small "reminder" advertisements on the theme "Mazda lamps stay brighter longer." In the provincial and trade Press, advertisements will concentrate mainly upon "Lighting to Measure" and the "Queen of Light" competition organized by the company to celebrate the diamond jubilee of light. The finals of this competition will take place in London on 20th December. In twenty areas, advertisements posing the question "Who will be your Queen of Light?" will appear in local papers before competition heats and will be followed by others showing a photograph of the winner. Advertisements will appear regularly in some ninety trade and technical papers.

Amongst the display material, probably the most novel of the new display units is a plastic illuminated showcard. This is in two colours stamped in relief on rigid white p.v.c. Two new "Lighting to Measure" cut-out showcards are available and two rather larger illuminated units have been produced primarily for use as central features for "Lighting to Measure" window displays. Applications for complete

A new Crompton lamp flashing sign

Left: A Siemens table lamp cut-out. Right: The cover of the new "Metrovick" lamp catalogue

window dressings should be made to the Lamp Advertising Department of the company, 18, Bedford Square, London, W.C.1.

Advertising of Royal "Ediswan" lamps by the Edison Swan Electric Co., Ltd., during the autumn and winter will be concentrated at the point of sale. Material now being made available to dealers includes window bills, four types of showcards and counter cards, a centre piece, a folding display piece portraying a group of Royal "Ediswan" lamp cartons and small "lamp supports" each of which carries a single lamp. This material is supported by normal trade and technical Press advertising, bus sides and reflex signs on all major roads throughout the country.

A national poster and Press advertising campaign for "Atlas" lamps and tubes is planned by Thorn Electrical Industries, Ltd., to commence on 1st October. Poster sites (16-sheet and 48-sheet) will be supplemented with bus sides, escalator and lift panels, and 4-sheet sites on the London Transport and British Railways systems. The new poster design continues the well-known "lamp with the glamorous eyes" theme but this time the lamp becomes the envelope of a balloon in the basket of which are two figures, one symbolizing "industry," the other "the home." The same theme will be used on the front pages of a series of Provincial and London evening newspapers.

A new "Ediswan" centre piece

An "Atlas" lamp poster

To tie-up at the point of sale a window-dressing service is being offered to retailers. The centrepiece of these displays is a large hanging cut-out of the "balloon" design, which is also available as 30in by 20in and 15in by 10in window bills and 22½in by 16½in showcards. Additional display material includes three "reminder" showcards in which actual lamps are incorporated in the shapes of animals.

POWER SUPPLY IN SOUTH AFRICA

Commission's Large Construction Programme

LAST year the Electricity Supply Commission of South Africa spent nearly £23 million on capital account, largely on the installation of new plant to meet the ever-increasing demand for electric power throughout the country. This is revealed in the Commission's report for the year ended 31st December last. During 1953 and up to 30th April last new plant with an aggregate rated capacity of 230,500 kW was installed. Unavoidable delays have, however, still retarded the programme of construction of new stations and extensions to existing ones. On the Rand undertaking in particular, a severe strain has been imposed on the Commission's resources by the expansion of gold mining and the rapid development of the uranium industry together with the requirements of associated industries and local authorities. Consequently it has not been possible to relax the restrictions on consumers' maximum demands in this area. A re-assessment of the requirements of the gold mining industry, including uranium production, for the next few years has revealed the urgent necessity for the provision of additional power, and steps have been taken to site and plan a new station.

A total of 9,442 million kWh was generated in the Commission's power stations last year and sales amounted to 8,732 million kWh, an increase of 8 per cent. Large users, such as the South African Railways, mines and industries, purchased nearly 80 per cent of the output, while the balance of 20 per cent was used to meet the requirements of over 100 cities, towns and villages in addition to farmers and smallholders. The growth of the requirements of local authorities is illustrated in a striking manner by the fact that the sum of the maximum demands of local authorities supplied in 1953 was about 400,000 kW, the comparative figure for 1945 being about 160,000 kW. In this period the Commission has incurred capital expenditure of £10–12 million to meet the needs of local authorities connected to its systems, and if the rate of growth of municipal undertakings is taken at 8 per cent per annum, the Commission's contingent responsibility is calculated at more than £1·5 million per annum for additional generating plant.

Steady progress has also been made with the provision of electricity to rural areas; during the past four years the Commission connected 2,882 rural consumers of whom 1,094 were farmers. The report states: "It has been found uneconomic to supply large farms. The best farming schemes are applicable in areas where there are numbers of small farms and where power is needed for farming in addition to domestic purposes. Escom's policy has always been and will continue to be, to supply farmers in all cases where funds and technicians are available and the supply is economically and technically practicable."

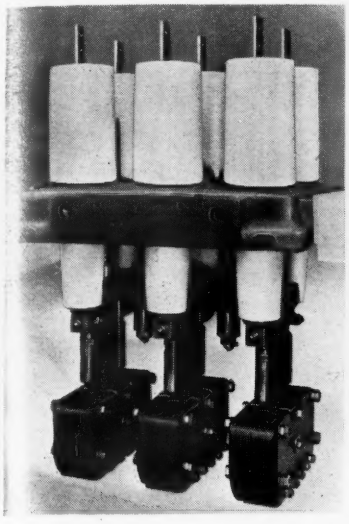
As foreshadowed in the annual report for 1952, the Commission was compelled to increase electricity charges in practically all of its undertakings to offset rising costs of coal, new plant installed, railage and other services. The increased revenue so obtained has enabled the Commission to convert a deficit of £418,282 at the end of 1952 into a small surplus (£931) at the end of 1953. It will, however, be necessary to make a further increase when new plant under construction or on order, purchased at the high prices ruling at the time, is brought into commission.

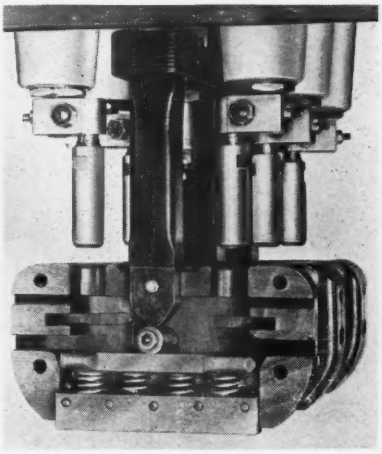
Capital expenditure on plant and works on the various undertakings has increased by £49 million during the past three years and now amounts to £109 million. This will be increased to approximately £185 million on completion of all the works to which the Commission is committed and on projected works.

I.H.V.E. Examinations

THE next examinations of the Institution of Heating and Ventilating Engineers will be held as follows:—Section A, 18th to 22nd April; Section B, 19th to 21st May. Candidates who have already submitted proposal forms for membership and have been accepted as examination candidates must submit an Examination Application Form (obtainable from the Secretary) before 28th February, 1955 (31st January for overseas candidates).

Candidates who have not previously made application are required to submit proposal forms for membership and these must be received by the secretary not later than 31st December next.





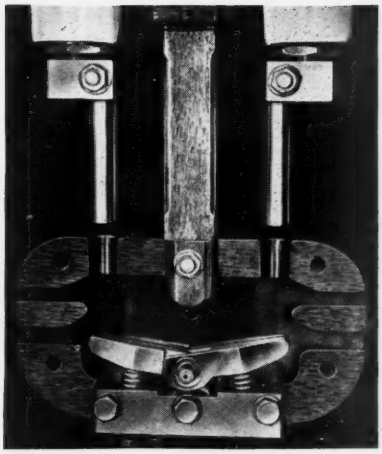


Fig. 1.—11 kV 150 MVA oil circuit breaker fitted with cross-jet bridges. Fig. 2.—An 11 kV 150 MVA cross-jet bridge with the front half removed. Fig. 3.—A 6·6 kV 150 MVA cross-jet bridge with the front half removed

The Cross-Jet Bridge

Its Use in Restoring Oil Circuit Breaker Performance

By D. R. DAVIES, M.I.E.E.*

THE arc-control device used with oil circuit breakers has hitherto consisted of some form of shroud surrounding the *stationary* contacts of the breaker. The assembly usually comprises a metal pot to which is bolted a stack of insulating plates that act as arc splitters. The cross-jet bridge developed by Metropolitan-Vickers is a distinct departure from this established form of arc control, in that the *moving* contacts of the breaker are enclosed by the arc splitters. Fig. 1 shows the bridge assembled in a small cubicle-type 11 kV breaker; the contacts are shown in the open position. Figs. 2 and 3 are views of the 6·6 and 11 kV bridges with one half removed to expose the contacts.

During the development of the bridge several hundreds of short-circuit tests were carried out to determine the requisite strength of the plates and to ensure that arc lengths and arc durations would have their smallest values throughout the range of currents covered by the rating.

Up to the present time the development programme has embraced breaking capacities up to 250 MVA and voltages up to 11 kV. From the many results recorded and analysed it would appear that the cross-jet bridge, when compared with the conventional pot, requires a shorter mechanism travel and occupies less space. It therefore offers certain advantages when used for small oil circuit breakers.

Referring to Figs. 1, 2 and 3, it will be noted that the bridge is constructed of a pair of thick impregnated laminated beechwood plates. Each plate has a routered cavity such that when the plates are bolted together—face to face—an interrupting chamber is formed to accommodate the moving contacts. The jet and throat are formed by milling out slots in the plates, half in one plate and half in the other.

The moving element (for a three-phase breaker) consists of a cross bar from which three insulating rods are suspended. At the end of each rod is bolted the bridge. The inspection or changing of contacts is extremely easy, the only tool required being a $\frac{3}{8}$in spanner. To remove the bridge it is necessary only to withdraw the bolt securing it to the end of the rod. The contacts can then be exposed for inspection or replacement by removing the bolts that fasten the two halves together.

It may be interesting to recall here two major criticisms that were aimed at this new type of arc control when the preliminary design was complete, but before it had been tested. It was suggested, first, that the increased area of the bridge might slow up the opening of the breaker; and secondly, that the increased weight might affect the load on the mechanism and upset the trip gear. However, as frequently happens when new designs are launched, the expected troubles proved of no consequence, and the troubles that did arise had not been previously envisaged.

The first series of short-circuit tests were very encouraging and after experimenting with different sizes of jet the design shown in Fig. 2 gave the most consistent performance for the range of currents covered by the ratings. The breaker (Fig. 1) fitted with the cross-jet bridge (Fig. 2) finally interrupted on the test plant all values of current up to 8,000 A to justify a rating of 150 MVA at 11 kV. A very simple contact was designed for this rating (see Fig. 2), but as it was intended to use this bridge for a breaking capacity of 150 MVA at 6·6 kV, further short-circuit tests were made with values of current up to 13,000 A. Although interruption was satisfactory the contact (Fig. 2) would not carry, without welding, the short-circuit current of 13,000 A for three seconds. It was therefore decided to design a more robust contact

* Metropolitan-Vickers Electrical Co., Ltd.

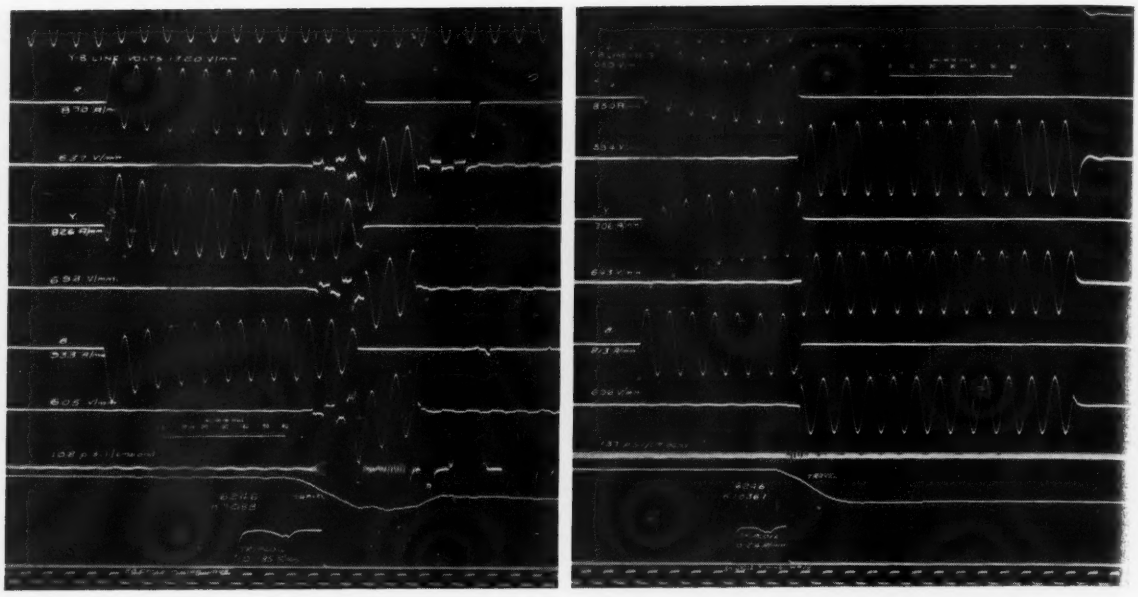


Fig. 4.—(a) Oscillogram showing failure of 11 kV 150 MVA breaker before fitting cross-jet bridges. (b) Oscillogram showing successful interruption by the breaker illustrated in Fig. 1

of the hinged finger type (see Fig. 3). This, using a rectangular " poker," successfully carried the short-circuit current for three seconds; it also interrupted currents up to 19,000 A on a three-shot duty cycle.

Restoration of O.C.B. Ratings

Up to the present the cross-jet bridge has been used mainly as a " restorative " for old breakers, and in this field it appears to have a very promising future. In this country and abroad there are probably thousands of untested oil circuit breakers the performance of which must be a constant anxiety to those engineers who are responsible for the safety of operators and the maintenance of power supply. Though the fitting of this type of arc control cannot make an old breaker into a new one, it does, undoubtedly, increase its reliability; the bridge eliminates the risk of prolonged arcing, which is a prelude to structural failure.

It must be remembered that the pre-1937 breakers were designed to meet the provisions of the 1929 edition of B.S. 116. In this earlier specification the short-circuit rating of an oil circuit breaker was based on the asymmetrical value of the current at the instant of separation of the arcing contact. Furthermore, this edition of B.S. 116 did not specify the method of interpreting recovery voltage; neither did it contain interdictory clauses limiting distress during proving tests. The pre-1937 breaker, therefore, cannot be expected to perform on a test plant in accordance with the more arduous conditions imposed by the later issues of B.S. 116.

Although the preliminary design of the bridge had been started early in 1952, it was not until the autumn of that year that it was assembled in a breaker and tested by the Switchgear Testing Company. The impetus then given to the development was largely due to the encouragement received from Mr. J. Henderson, chief engineer of the South West Scotland Electricity Board. In this Area, which is no exception, there are a large number of old breakers having ratings that were assigned before the 1937 edition of B.S. 116 was published. After an investigation into system conditions by the Area Board engineers, it was considered desirable to subject one of these breakers to a series of short-circuit tests and thereby establish its rating at 11 kV under test-plant conditions. Starting at a low value of MVA, the break tests were increased until the breaker interrupted 114 MVA; at this value, however, it showed considerable distress; on the next shot, corresponding to about 120 MVA, it blew up.

Various ways of improving the performance of this breaker were considered, but all the known methods had to be rejected as either impracticable or too costly. The first suggestion, to fit a cross-jet pot on the ends of the insulators in the breaker, was quickly ruled out. First, because the tank was too small to accommodate a tested standard pot. Secondly, it was known from past experience that a porcelain insulator which had been designed to carry the usual type of stationary finger contact would be much too weak to support any kind of side vented arc control, even one specially designed for the duty. The insulator usually fractures during short-circuit interruption because of the side thrust imposed by oil and gas expulsion through the side vents of the pot.

Finally, a breaker having an arc-control device mounted around the stationary contact must have a mechanism travel long enough to provide clearance, in the open position, from the end of the " poker " to the bottom of the pot. Although arc lengths shorter than the stroke are obtained on test, some proportion of the stroke must be inactive. It is essential that arc extinction occurs within the confines of the pot; therefore additional travel of the moving contact is necessary to ensure that it is completely withdrawn from the throat of the pot after final interruption. As the stroke in this breaker is only 3·25in long, it would have been quite impossible to fulfil all these conditions by using a conventional design of arc-control device mounted around the stationary contact.

To replace these old breakers by a modern type fitted with an arc-control device would have cost the Board a considerable sum of money. Moreover, there would have to be faced the additional cost of modifying the cubicles to accommodate the new and larger breakers. Capital expenditure which does not increase revenue is always

very difficult to justify, but a doubtful circuit breaker is a menace to continuity of supply and to the operating staff; it is thus a problem, however unpleasant, which has to be faced.

Accordingly, when it was found possible to accommodate a cross-jet bridge in these old breakers, although there was no test experience to justify the designer's optimism, Mr. Henderson and his engineers gave their whole-hearted support to the proposal to proceed with the development and manufacture of a prototype for test.

After overcoming the preliminary troubles, described previously, a breaker fitted with bridges (see Fig. 1) was subjected to a complete series of tests and qualified for A.S.T.A. Certificate No. 3164 covering a rating of 150 MVA at 11 kV. The oscillogram (Fig. 4a) is a record of the breaker, without the cross-jet bridge, attempting to interrupt 120 MVA at 11 kV; on this test it blew up. Fig. 4b shows the performance of a similar breaker fitted with bridges. This oscillogram is one of the 150 MVA break-shots at 11 kV, forming part of the A.S.T.A. series. After interrupting the 100 per cent duty cycle, i.e., three breaks at three-minute intervals, the breaker satisfactorily withstood a pressure test of 27 kV for one minute between poles with the contacts in the open position.

Despite the age of the breaker it was rather remarkable that throughout the whole series of tests there was a complete absence of oil emission from either vent or tank joint. This was probably due to the use in the bridge of long jets, which tend to prevent hot gas entering the oil tank; the very low tank pressure recorded during interruption is probably explained in a similar way.

TABLE I

Amps	A				B		C		D	
	6·6 kV		11 kV Recovery							
	Rectangular Tank with C.J. Bridge				Round Tank with C.J. Pot		Round Tank with C.J. Bridge		Rectangular Tank with C.J. Bridge	
	Arc Duration ½ cycles	Arc Length inches	Arc Duration ½ cycles	Arc Length inches	Arc Duration ½ cycles	Arc Length inches	Arc Duration ½ cycles	Arc Length inches	Arc Duration ½ cycles	Arc Length inches
800	No Test		2·2	1·3	2·7	1·9	2·3	1·6	2·8	1·8
1,300	1·7	1·0	No Test		2·1	1·6	2·1	1·4	2·6	1·7
2,600	No Test		2·6	1·6	2·0	1·5	2·1	1·4	2·1	1·4
3,900	1·9	1·3	No Tests							
4,700	No Test		2·3	1·4	1·5	1·2	2·1	1·6	2·0	1·4
8,000	1·4	0·8	1·7	1·0	1·4	1·2	1·9	1·2	1·2	1·0
10,000	No Test		1·7	1·1	1·2	1·2	No Test		1·6	1·1
13,000	1·3	0·6			1·1	1·1	1·7	0·8	1·6	1·0
18,000	1·0	0·3			1·1	1·1	No Test		1·0	0·5

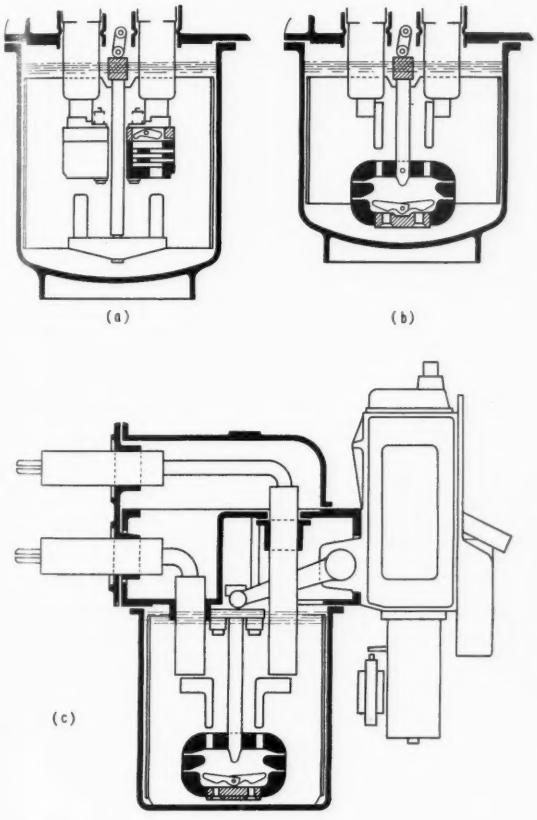
Having proved that the cross-jet bridge would restore the breaking capacity of this breaker at 11 kV, in accordance with the requirements of B.S. 116 : 1952, it was decided, in view of the large number of similar breakers in service at 6·6 kV, to proceed with further tests to establish a rating of 150 MVA at that voltage.

As mentioned previously, the more robust design of contact shown in Fig. 3 was developed for this rating. The same breaker was, however, used for the complete series of tests and A.S.T.A. Certificate No. 3248 covering a breaking capacity of 150 MVA at 6·6 kV was issued. The arc durations and arc lengths obtained on the test plant are entered in column A, Table I.

Up to this stage the development work was concerned, mainly, with producing a bridge that could be accommodated in a particular small breaker (Fig. 1). The results were so encouraging that it was decided to extend the application of the bridge to include larger breakers having a short-circuit rating of 250 MVA at 11 kV. For this duty the bridge (Fig. 3) was modified by increasing the distance from the contact tip to the throat entrance. A modern round tank breaker (Fig. 5b) was then fitted with this larger bridge and subjected to a complete series of short-circuit tests; the results are given in column C, Table I. Further tests were then made on the same bridge assembled in a metalclad breaker of the horizontal draw-out type (Fig. 5c). These results are entered in column D, Table I.

In Fig. 5 three breakers all drawn to the same scale are shown: (a) is a modern round tank breaker fitted with cross-jet pots, the test results of which are shown in column B; (b) is the same breaker with a shorter tank fitted with bridges; (c) is a rectangular tank breaker also fitted with cross-jet bridges. Comparing Fig. 5a and Fig. 5b it will be noted that the bridge enables the tank volume to be reduced about 17½ per cent.

Fig. 5.—Comparison illustrating the reduction in tank volume by using cross-jet bridges



Conversion of Breakers

To assemble the cross-jet bridge in a breaker it is not necessary to return it to the works or even remove it to a workshop. Consequently, the breaker need only be withdrawn from service for a few hours. The time required to convert a breaker depends on its condition

and on whether it is mounted in an accessible position. This latter point applies more particularly to cubicle mounting types.

On one occasion, which is probably exceptional, two maintenance fitters removed the existing contacts and replaced them with cross-jet bridges in two hours. It should be noted, however, first that the job was carried out in the Board's workshop; secondly that the breaker mechanism did not require re-adjustment; and finally, that the fitters did not have to rectify burred threads or other worn or damaged parts. Such troubles often make it impossible to give an accurate estimate of the time required for work of this nature. Nevertheless, taking into account the most difficult conditions that may be encountered, a couple of fitters should complete the conversion of a small breaker in four hours.

Whether a supply authority should restore the performance of old breakers by fitting cross-jet bridges or, alternatively, buy new breakers, depends very largely on the age and condition of the breaker. If it has been well maintained and is of the cubicle type using porcelain insulators, then its breaking capacity can be restored and its useful life prolonged by fitting cross-jet bridges. This can be achieved at considerably less cost than the cost of new breakers. If the breaker is of the metalclad type using varnished paper bushings its age must be considered and the data obtained indicating the quality of the insulation before fitting any type of arc-control device.

Mining Mechanics and Electricians

Memorandum on Regulations

A MEMORANDUM on the Coal Mines (Mechanics and Electricians) General Regulations, 1954, by the Ministry of Fuel and Power was published last week (H.M. Stationery Office, price 6d net). The object of the Memorandum is to state the intention behind the most important of the provisions of the new Regulations. It is designed to give guidance on their application to managers, mechanical engineers or mechanics in charge, electrical engineers or electricians in charge, mechanics and electricians of the mine and others most concerned with their provisions.

The object of the Regulations is to secure the proper installation, examination, testing and maintenance of mechanical plant and electrical plant of which more and more is being installed in mines. The Royal Commission on Safety in Coal Mines which reported in 1938 emphasized the importance of this matter, and the growing use of electricity in mines and intensive mechanization in recent years has increased the need for new requirements. These Regulations are based on the recommendations of the Royal Commission. They are, moreover, the last of a series of Regulations dealing with the duties and qualifications of mine officials, engineers and technical staff which have been introduced in consequence of the power taken in Part II of the Coal Industry Act, 1949, to implement the relevant proposals of the Royal Commission.

Part I deals with appointments. Under Regulations 1 (1) and 2 (1), the manager has to appoint for every mine to which the Coal Mines Act, 1911, applies, a competent person to be the mechanical engineer or mechanic in charge of the mechanical plant, and a competent person to be the electrical engineer or electrician in charge of the electrical plant. The manager must also appoint sufficient mechanics and electricians to enable the man in charge to carry out his duties under the Regulations.

Regulations 1 (1) and 2 (1) require the appointments of mechanical and electrical staff to be made for every mine. The words " for every mine " are important as these enable a competent person to carry out the specified duties at more than one mine, provided that the responsibility involved is such that he can carry out those duties at each mine fully and effectively.

Part II deals with duties. The mechanical engineer or mechanic in charge and the electrical engineer or electrician in charge is responsible for the proper installation, examination, testing and maintenance of mechanical or electrical plant respectively at the mine: he has either to carry out these duties for this plant himself, or to supervise the work of mechanics or electricians of the mine, or other persons carrying out those duties.

The Regulations set out the duties of mechanics in respect of mechanical plant and electricians in respect of electrical plant under four headings (Regulation 5). They have either to supervise or themselves to carry out:—(*a*) The installation of all plant; (*b*) the examination and testing of all plant before it is put into use after it has been newly installed, or re-installed or repaired; (*c*) its maintenance in safe working condition in accordance with the Regulations; and (*d*) the systematic examination and testing of all plant in accordance with schemes referred to.

Two restrictions are made in the interests of safety: (*a*) The man instructed should not carry out any work on the installation, repair, examination or testing of either mechanical plant or electrical plant for which technical knowledge and experience are necessary to avoid danger, without supervision by a mechanic or an electrician; (*b*) special precautions must be taken before work can be carried out on any conductor working at a potential of more than 25 V, or near to any such conductor which is exposed.

Regulation 8 lays down special precautions to be followed by a man operating electrical plant worked with a flexible trailing cable. A man operating, for example, a coal cutter, conveyor or loading machine should not: (*a*) leave it working unless his instructions expressly authorize him to do so; (*b*) leave his working place, unless his instructions expressly authorize him to do so, without making sure that the flexible cable has been made dead. When remote control is provided for association with the electric cable, the power is generally automatically cut off from the cable when the machine is switched off.

Before first starting to use a trailing cable in any shift, the man must examine as much of it as he can get at at that time, and throughout the shift he must examine any other parts that become accessible. This is designed to cover cases when the flexible trailing cable is supported from girders in a figure of eight or flaked on a bollard at the beginning of a shift and cannot then be readily examined over its whole length. This Regulation does not permit a flexible cable which is, for example, buried behind a stopping, to be used: such a condition would conflict with the requirements of Regulation 124 (*a*) of the General Code of 1913, that the cable should be installed and maintained so as to prevent danger. Any cable found to be damaged or defective must not be used and should be replaced forthwith by cable in good condition.

Part III deals with qualifications. These are required in three successive stages which are set out in Appendices 1 and 2; Stage 1 commences on 1st January, 1956, Stage 2 on 1st January, 1957, and Stage 3 on 1st January, 1959. The intervals between these Stages have been spaced so that the men concerned will have an opportunity either to win certificates from the Mining Qualifications Board or to gain sufficient experience to qualify for service certificates.

VIEWS on the NEWS

By REFLECTOR

THAT colourful lighting has a never failing attraction is shown by the millions of people who flock annually to the seaside towns, after the normal season is over, to see the illuminations. Equally, I am sure, is it true that the lights of a city's shops are not only good publicity for the businesses themselves but also give the town a reputation for being "alive." This view, I am glad to see, is shared by the Lord Mayor of Hull who, when a recent application for permission to erect a neon sign came up for consideration, remarked: "Are we going to have a bright city or a dull one? It is very nice to come at night into a city where there are all kinds of red and green and white lights. Look at the Electricity Building. It gladdens your heart when you see it."

* * *

The building referred to belongs, of course, to the Yorkshire Electricity Board, another sphere of whose activities has also recently evoked favourable comment. In Gainsborough it unfortunately became necessary for the Board to take up a newly laid pavement for cabling purposes and onlookers were prepared for the worst. However, according to the local Press:

> ". . . they need not have worried. The reinstatement was as thorough as anything we have seen. Every slab went back neatly into place with little sign of disturbance. The soil was brushed off the verge and next day there was no trace of the upheaval of the previous day."

Evidently the Board's employees on this particular job were married men.

* * *

Reverting to the subject of lighting, I see that at Blackpool, where the famous illuminations were switched on last Friday for yet another season, the revenue to the town is estimated at £3,000,000. This is the amount that visitors are expected to spend during the extra six weeks' season. According to the *West Lancashire Evening Gazette*, 14,000,000 visitors have seen the illuminations since 1949 when they were restarted after the war and this year the total is likely to reach 20,000,000. The cost of presentation of the illuminations is given as £77,000 and the value of the equipment as £323,000. Some 575,000 kWh will be consumed. There can be no doubt that the scheme continues to bring great benefit to the town and provides extended employment for thousands of seasonal workers.

* * *

According to the *Esher News & Advertiser*, a local lecturer on electricity in the home is credited (or perhaps I ought to say "debited") with a statement that is likely to cause alarm and despondency among its readers. The statement is that more people died in their own homes last year through electrical faults than were killed on the roads. I have no figures for last year, but in 1952 there were 56 known fatalities due to the use of electricity on domestic premises compared with 4,706 in street accidents. The reason for the alleged increase of more than 8,000 per cent in one year in the former case is not divulged, which is a pity. In contrast with the sensational and no doubt exclusive information on which the statement presumably rests, the suggestion, also reported, that a small electric fire set high on the wall out of reach is safer than one of the portable variety in a bathroom, although sound, seems remarkably mild.

* * *

As a rule electrical fatalities in the kitchen arise from wet or damp conditions accompanied by the failure of earthing arrangements. But at a recent inquest in South Wales it was held that a woman's death was due largely to dry weather which had rendered the earthing of an electric kettle useless. An electrical witness said that there had been a fault in the switch-plug, which was overloaded, and the earthing system had failed to act. Had the weather at the time been wet the system would have been more effective. The nature of the earthing arrangement was not mentioned in reports of the case, but the fatality seems to point to a need for periodical tests of earthing systems which, on the surface, are in good order. It also strengthens the argument for earth leakage trips which Mr. T. C. Gilbert has often put in the *Electrical Review* and elsewhere.

* * *

While the British Electricity Authority is proceeding with its experimental wind-power plants I do not think that its hopes run quite so high as those of a writer in the *Yorkshire Evening Press* who says:—

> "Within a few years the coasts of these islands are likely to be dotted with giant windmills, generating electricity and saving millions of tons of coal a year."

It is true that later in the article the "millions of tons" turns out to be a possible two million. The writer also visualizes a valuable export trade in windmill generators if the British development is successful. I feel that there is a touch of castles in the air about this.

* * *

A suggestion that an electricity discharge might be used for dispersing fog was made by Sir Oliver Lodge (then Professor O. J. Lodge) in a lecture at the 1884 meeting of the British Association in Montreal, a report of which appeared in the *Electrical Review* of 20th September of that year. Remarking that as members of the Association had lain idle for some hours outside the Straits of Belle Isle in the midst of icebergs mingled with fog, he said it was impossible not to be struck by the advisability of dissipating the fog. It would be rash to predict what could be done; it was rasher still to predict what could not. He continued: "On board a steamer are engines; these engines can drive a very powerful Holtz machine, one pole of which can be led to points on the masts. When electricity is discharged into fog on a small scale it coagulates into globules and falls as rain; perhaps it will on a large scale too." The Professor said he was not too sanguine but it would not cost much to try. If it kept only a small space in front of the ship fairly clear it would be useful.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

THE General Post Office Headquarters has announced that an additional post of Deputy Director General has been created for a limited period to deal with pressure of broadcasting work. It will be filled from 18th October next by **Sir Ben Barnett,** K.B.E., C.B., M.C., who is now in charge of this side and will be freed to devote all his attention to broadcasting. The Postmaster General, with the approval of the Prime Minister, has appointed **Sir Gordon Radley,** C.B.E., Ph.D.(Eng.), Engineer-in-Chief, to be Deputy Director General to fill the vacancy on the permanent establishment.

The following appointments have also been approved by the Postmaster General:—**Brigadier L. H. Harris,** C.B.E., B.Sc., M.Sc.(Eng.), Controller of Research, to be Engineer-in-Chief in place of Sir Gordon Radley. **Mr. G. J. S. Little,** C.B.E., G.M., Assistant Engineer-in-Chief, to be Controller of Research in place of Brigadier Harris.

Sir Ben Barnett was educated at Christ's Hospital and Trinity College, Cambridge, and entered the Post Office in 1920. He became principal in 1930, assistant secretary at Headquarters in 1939, regional director, Home Counties, 1945, Director of Inland Telecommunications in 1946 and Deputy Director General in 1949. He was awarded the K.B.E. in 1952.

Sir Gordon Radley joined the Post Office Engineering Department in 1920. From 1944 to 1949 he was Controller of Research, and from 1949 to 1951 Deputy Engineer-in-Chief, being appointed Engineer-in-Chief in the last mentioned year.

Sir Ben Barnett

Sir Gordon Radley

Brigadier L. H. Harris

Mr. G. J. S. Little

Brigadier Harris served in Australian Signals in the 1914-18 world war. He worked in the G.P.O. Engineering Department from 1922 to 1949 and during the last war he was Chief of Telecommunications, S.H.A.E.F. (1943-45). He then became Regional Director G.P.O. Scotland (1945-49) and since 1949 has been Controller of Research.

Mr. Little joined the Research Section, Lines Transmission, in 1922, and became the chief regional engineer, North West Region, in 1939. In 1945 he was appointed staff engineer in the Radio Maintenance Branch and Assistant Engineer-in-Chief in 1947. Mr. Little received the George Medal for saving from destruction by fire the Manchester Central Automatic Telephone Exchange in 1940.

Mr. Eric S. Chisholm, who has joined the staff of Heatrae, Ltd., as London sales manager, has served the electrical industry for about twenty years, firstly in the G.E.C. Experimental Test Room at Wembley, then with the Northmet Power Co., and later as district commercial officer, Eastern Electricity Board, Chilterns Sub-Area at Luton, from which position he resigned to join the Simplex Electric Co. as sales manager of its Electric Water Heating Department. He will be assisted in his work with Heatrae by Mr. A. E. Knight, who is well known in the London area.

Mr. E. S. Chisholm

Mr. Frank Christy has relinquished the chairmanship of the Christy Bros., Ltd., group of companies, but retains his directorships. He is succeeded as chairman of Christy Bros. by **Mr. A. A. Gates.**

Mr. R. C. Cox has joined the board of the Kenwood Manufacturing Co., Ltd. He is assistant managing director of Fisher & Ludlow, Ltd., and a director of Bendix Home Appliances, Ltd.

Mr. H. J. Finden, M.I.E.E., chief engineer of the Electronic Instruments Laboratory of the Plessey Co., Ltd., left this country for the United States on 3rd September to attend the official opening on 8th September of the new laboratory of the United States Bureau of Standards at Boulder, Colorado. He will be in the United States for several weeks making a general study of computing problems and electronic controls.

Mr. E. Bruhn, manager of the London branch office of the Danfoss Manufacturing Co., Nordborg, Denmark, has retired from the firm. The branch office at 69, Victoria Street, S.W.1, will continue as hitherto.

I.T.D., Ltd., has lost the services of **Mr. R. J. L. Fish,** export sales manager, and **Mr. John R. S. Halford,** who has been acting as Mr. Fish's assistant since early 1951, has been appointed to succeed him as export sales manager. Mr. Halford before the last war gained initial engineering experience with the De Havilland Aircraft Co. at Stag Lane. In 1940 he joined the R.A.F. and as a fighter pilot and test pilot he was awarded the D.F.C. Since the war he has held various positions on the sales or export sides of a number of companies associated with general mechanical products. Mr. Halford, under the guidance of the general manager, Mr. A. C. Cooper, is reorganizing the whole of the I.T.D. Export Sales Branch to cope with the increasing business.

Mr. J. R. S. Halford

Mr. Oliver Lyttelton, upon whom a viscountcy was recently conferred, is to take the title of Viscount Chandos of Aldershot.

To mark the completion of twenty-five years' service with the Pyrene Co., Ltd., and as an expression of their esteem, his colleagues in the metal finishing division and laboratories have presented **Mr. W. E. Wright,** a director of the company, with his portrait painted by S. J. Iredale. Throughout his long association with the Pyrene Co. Mr. Wright has been in charge of its metal finishing division and was the first man to promote in this country the adoption, on a fully commercial scale, of phosphate processes for rust proofing and later on for paint bonding. As a result of his work in developing the use of phosphate coatings and in initiating original research in the chemistry of surface reactions, Mr. Wright was

elected to the Fellowship of the Chemical Society in 1944.

The annual ball of the **Electrical Trades' Commercial Travellers' Association** will be held on 1st October at the Park Lane Hotel, Piccadilly, London, W.1. Tickets (7s. 6d. each) can be obtained from Mr. L. A. Fickling, c/o Linolite, Ltd., 18, Baker Street, London, W.1.

After the August break the eighth monthly luncheon of the **Electrical Industries Club** was held at the Connaught Rooms, London, on Tuesday last when Mr. F. J. Erroll, M.A., A.M.I.E.E., A.I.Mech.E., M.P., who is a member of the Council of the Institute of Directors, gave an interesting address on the recent activities of this institute particularly with regard to expenses and taxation.

On 4th September **George Kent, Ltd.**, held an "open" day at their Luton works, and 2,500 people, including families of employees, took advantage of the perfect weather to look over the works and enjoy a programme of events which included a flower show, demonstrations by the works fire brigade and works civil defence, a glass blowing demonstration and an exhibition of models constructed by the works Model Engineering Society.

Blackpool Illuminations

BLACKPOOL Corporation's £400,000 illuminations, which cover six miles of sea front with miles of festoon strip and more than 100 tableaux and features, were switched on by Mr. Gilbert Harding (radio and television personality) last Friday. Research and study into decorative colour lighting effects has enabled Blackpool lighting engineer (Mr. Harry Carpenter) to introduce new and brighter colours. Fluorescent lighting and duo-colour lighting have a place in the illuminations for the first time. The official platform at the inauguration ceremony was illuminated with xenon arc lighting, designed by Mr. Carpenter in conjunction with Dr. J. M. Aldington (managing director, Siemens Electric Lamps & Supplies, Ltd.). The switch-on ceremony included a 400 million lumens electronic xenon flash, lasting 1,000th of a second. The illuminations proper were operated from the same switch.

Interesting facts and figures about the 1954 Blackpool "Lights" are: Value of equipment, £323,000; expenditure this year, £77,000; festoon strip, over 50 miles; cable and wiring, over 75 miles; lamps (more than 100 different types), 325,000; tableaux and features, over 100; longest tableau, 650ft; floodlighting and searchlights, 1,500; pylons and columns of light, over 1,000; decorative designs, over 1,000; electricity demand, 2,400 kW; and electricity consumed (period of 6½ weeks), 575,000 kWh. Eighty workmen are engaged all the year, increasing to 150 in the weeks immediately before the illuminations.

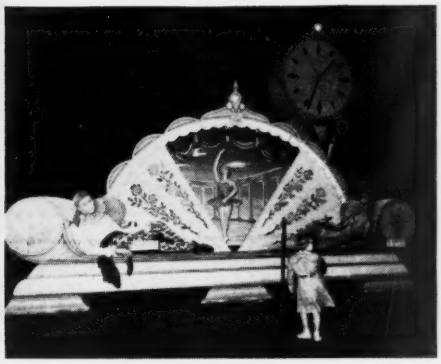
During the course of the illuminations between 500 and 600 yd of neoprene moulded cable is being introduced and its performance, operational efficiency and wearing qualities compared with those of rubber and traditional wiring.

The lamps used vary between 10 and 25 W and while the aim is to increase cable carrying capacity by using the low wattage lamps, the tendency this year has been in the direction of higher wattages and greater concentrations. Colour has assumed greater importance. Hundreds of tints have been used. Though red, oranges and yellows predominate in patterns and designs, blues, greens and cerises are used to build up vivid contrasts. In this connection, problems associated with duo (alternative) colour lighting in outdoor schemes have been overcome. This treatment is used with diagonal festoons to provide canopies of light. Supporting pillars are in the form of coloured halo-type pylons. Another half mile of the promenade is specially festooned to form a tunnel of light, with each 150 yd section illuminated in selective mono-colour lighting. The outstanding feature, however, is "Oriental Avenue" in which more than 1,000 oriental lanterns of authentic design and colour are suspended along and across the roadway with decorative oriental banners hung from standards flanking each side. Specially designed multi-colour archways define this section. Another stretch has an avenue of scintillating laburnum trees with a colour-changing rainbow arch as the centre-piece.

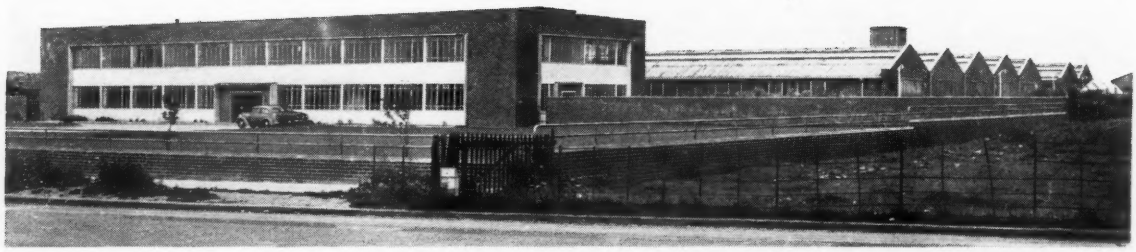
On some sections of the promenade new permanent fluorescent lighting has been effectively used as a background to the illuminations. Lanterns with eight 2ft 40 W tubes have coloured screens. All the fluorescent lighting columns have been specially designed.

The Town Hall facade enjoys a completely novel illumination treatment. The fenestrations are outlined in gold lamps relieved by purple motifs, and the horizontal lines of the building are emphasized with flower boxes and fleur-de-lis and are lit with green fluorescent lamps.

The official illuminations scheme is augmented by many excellent private displays.



Two examples of the Blackpool Illuminations showing (right) oriental lighting on the promenade, and (below) a "3D" chiming clock with mechanical animation



Medway College of Technology

New Buildings Brought into Operation

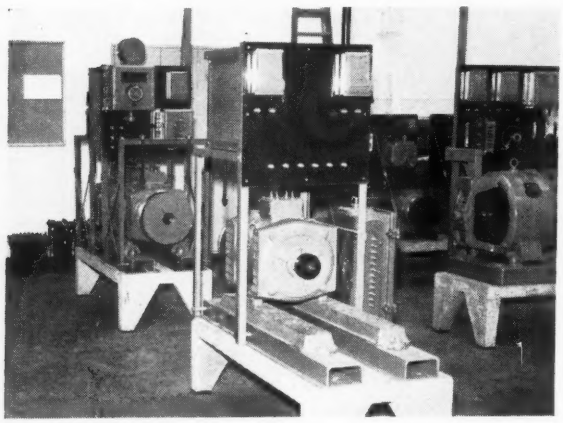
THE new buildings for the Medway College of Technology at Fort Horsted on the Chatham/Rochester boundary were brought fully into use this week. The college was founded in 1906 and has occupied various buildings in the Medway Towns of Rochester, Chatham and Gillingham. The new buildings occupy a 7½ acre site, the cost of purchasing and adapting it and installing equipment additional to that already belonging to the college being about £500,000.

The college is a regional one attended by about 6,000 students. It offers degree courses in mechanical, civil and electrical engineering (including radio engineering), chemistry, physics and zoology, in addition to industrial and trade courses in the departments of engineering, science, commerce and building. As a regional college, it will serve not only the Medway Towns but will be a centre for advanced work for a wider area. The college is administered by the Kent Education Committee through its Further Education Sub-Committee and a Board of Governors. The Principal is Mr. C. Colles, B.Sc., A.M.I.Mech.E.

There are five main departments, each with its own head, these being: (1) mechanical, civil and electrical engineering; (2) science (including chemistry, physics and biology); (3) commerce; (4) building; (5) adult education and day continuation (education in non-vocational courses).

The engineering departments of the college include a heat engine laboratory, a strength of materials laboratory, two applied mechanics laboratories, four electrical engineering laboratories (including radio and telecommunications laboratories), an engineering research laboratory, welding shop, sheet metal shop, machine tool shop, machine tool testing laboratory, foundry, heat treatment room, metallurgical microscope room, metrology laboratory, electrical installation shop and motor trades shop, drawing offices, lecture rooms and classrooms.

A corner of one of the electrical engineering laboratories



The electrical installation of the buildings comprises main distribution cables laid underground from a floor-mounted switchboard with 800 A o.c.b. and h.r.c. switch-fuses. The machines in the electrical laboratory are connected through change-over switches to a ten-pole overhead busbar chamber supplying variable and fixed a.c. and d.c. voltages. Low voltage d.c. supplies in the laboratories are provided from a 120 V 120 Ah capacity battery through a main connector panel, 10 V tappings being taken from the battery to the panel. Low voltage supplies are provided from air-cooled transformers. Electrical supplies to the machine tools are taken from an overhead busbar system through fused tap-off units.

Lighting generally is by means of fluorescent fittings connected on the twin-lamp principle, with tungsten lighting in the refectory and common rooms. The road lighting system is time-switch operated. The total connected load is about 1,200 kW.

The fire-alarm system, operating on a closed circuit, is so arranged that the operation of any particular fire alarm contact is indicated on the panel in the administration building and, at the same time, all local bells will sound. There is an automatic internal telephone system covering all departments of the college.

The architect for the adaptation of the buildings has been the Kent county architect. The consulting engineers for the mechanical engineering and electrical engineering services were Messrs. J. Stinton Jones & Partners, of Maidstone, who, in collaboration with the Principal and the Heads of Departments of the college, were also responsible for the layout of the equipment in the laboratories. The consulting engineers for the structural steelwork and reinforced concrete work were Messrs. Scott, Wilson, Kirkpatrick & Partners, of London.

Bristol Radio Exhibition

Marconi Marine radio communication equipment, radar and echometer apparatus will be on display at the exhibition being staged in the Royal West of England Academy, Bristol, on 17th, 18th and 19th September in connection with the National Convention of the Radio Society of Great Britain. The exhibits have been selected as representative of the latest techniques in transmission and reception, radar and echo-sounding.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Refrigerator Guarantees

I WAS interested to read " Reflector's " recent comments concerning the satisfactory service which he has obtained from electrical equipment and should like to relate my own experience.

Some three years ago I purchased a refrigerator at a little under £100 carrying a five year guarantee on the hermetically sealed unit. After about twelve months rust spots appeared on one side panel and later spread to the floor. Knowing the moving parts were guaranteed over a lengthy period I assumed that no immediate action was called for and decided to see how far the damage had gone before taking the matter further.

About six months ago I wrote to the local Electricity Board office (through whom I had purchased the equipment) and asked them to take the matter up with the makers, which they did after inspecting the damaged areas.

The reply now received is that the cabinet is guaranteed for twelve months only (the first time this has been mentioned) and that the makers, if I wish, will quote me for a new side panel, the rusting of which now extends continuously over 1 sq ft. The door has not been mentioned, presumably because the price would be rather frightening.

I wonder how many people realize that the part of the refrigerator which should be least vulnerable, and not in need of a lengthy guarantee on that account, is the very item which is scamped and will let them down. I think you will agree that for most people it is not an easy thing to find the money for a non-essential item in the first place, and if they do, they expect it to be something which will grace their homes for some years to come, rather than an eyesore to be hidden in a corner.

" CAVEAT EMPTOR."

Variable-Speed A.C. Drives

IN reply to Mr. K. B. Blake's letter, in your issue of 10th September, commenting on my article, I should like to point out that it is difficult to condense an article about a wide and complicated subject without some of the statements being capable of misinterpretation.

On the question of maintenance my considered comment was—" Maintenance costs may be somewhat higher on the d.c. motor schemes as there is the extra equipment to maintain and possibly a more highly trained staff is needed." I believe this to be an unbiased summary of the position. Mr. Blake says that experience on rectifier d.c. drives has shown that the d.c. motors require less attention than a.c. machines. This suggests erroneously that experience on one sort of drive enables a comparison to be made between that sort and another; further it is liable to be misinterpreted to mean that the d.c. motor and its rectifier equipment requires less attention than an a.c. motor, although this is not claimed. Experience, over more years than I care to count with both d.c. and a.c. motors indicates that there is nothing to choose between them for brush wear if they are of comparable design but that generally the a.c. commutator wears less than the d.c. I think that Mr. Blake's opinion on brush replacement cost is unfair and is not in line with my experience which covers large numbers of machines of both sorts.

Mr. Blake's second point is equally liable to misinterpretation because a.c. motors can be designed to have different characteristics and can be reversed with ease if necessary, whereas his statement indicates that this is not so. Series a.c. motors give much superior load sharing than d.c. machines when running in parallel. This again is not just an opinion, it is knowledge based upon very considerable experience of many drives requiring a number of motors to run in parallel with each other both with a.c. and d.c. motors, but I did not say load sharing was a feature peculiar to the a.c. series motor, as suggested by your correspondent.

I am grateful to Mr. Blake for his mention of stator-fed motors because it has drawn my attention to an ambiguous statement in my article. I said stator-fed motors were used on drives up to about 1,000 h.p. and more when the speed range is limited; the meaning would have been clear if there had been a comma after the h.p., i.e. that they are made for powers larger than 1,000 h.p. when the speed range is limited.

Mr. Blake's comment about enclosures is positively misleading because both d.c. and a.c. motors can be and are made with a variety of enclosures for use in dirty situations and in hazardous vapours. When valves or rectifiers are used with variable armature voltage only, the d.c. machine is usually smaller than the a.c. equivalent, but this form of control can only be used where a low power factor does not matter. In the case where shunt regulation is used for about half of the speed-range of the d.c. motor, the corresponding a.c. motor is no larger than the d.c. motor.

Finally, I agree there is no really simple answer to the problem of selecting variable-speed drives, but consider the concluding paragraph of my article based on long experience of both a.c. and d.c. motors to be a perfectly unbiased statement of the position.

Hebburn-on-Tyne. A. T. ROBERTSON.

Earthing Methods

REFERRING to Mr. T. C. Gilbert's letter in the *Electrical Review* of 6th August, I would assure him that I too have had experience of voltage operated trips installed in my own house, and as the conditions were satisfactory the trips operated well. Mr. Gilbert will, however, appreciate that only a small proportion of householders are electrical engineers, and it hardly appears to be a good thing to encourage the testing of earth trips by the methods advocated by him, and I do not like to think what might happen to one of the ladies of his household should the trip fail to operate one day when she is inserting the cooker cloth hook into the kettle connector.

I, of course, agree with Mr. Gilbert's remarks relating to the comparatively high impedance of several red lead joints between the cold water main, storage tank and hot water cylinder, and agree again that with this type of installation a voltage operated trip will in most instances provide protection against excess voltage. However, to-day an increasing number of combined cistern and hot water cylinders are being employed; moreover plumbing work is carried out in copper piping employing low electrical resistance sweated couplings. Quite frequently a block of six or eight houses is supplied from one copper service pipe tee-ed off an asbestos main, and therefore the voltage gradient which can be obtained by driving down an earth

rod within the curtilage of the premises is frequently insufficient to operate an E L trip. In such circumstances, which are not uncommon in rural areas, the danger of shock due to non-operation of a trip is not just limited to a shock from the faulty appliance, but extended to any occupant of any of the properties fed by the particular water service.

In Mr. Gilbert's original article in the "*Review*" of 9th July he quoted a case where, to obtain satisfactory operation of a trip, it had been necessary to place the trip electrode some 75 yards away from the appliance, but said that the difficulty was overcome by attention to the alternative path. In this case, a pump installation, the suction pipe, buried six feet in the ground, was insulated with half-round sections of stoneware piping. Surely this is an instance where Mr. Gilbert would have lost the bet set out in the penultimate paragraph of his last letter, or if not, all the digging was unnecessary. It is this type of installation and not the high resistance, red-leaded water pipe cases, which I still contend could best be afforded protection by differential current trips.

I therefore accept the offer contained in the last paragraph of Mr. Gilbert's letter and trust that the equipment is not so expensive as to make its use impracticable for domestic installations.

It is fairly evident from the present trend that unless manufacturers of earth leakage protection devices do produce an answer to the problem they will eventually lose the sales of all this class of equipment for installations in new rural electrification areas, as the Electricity Boards will have no alternative to employing protective multiple earth which, of course, will be an excellent thing for all concerned except the manufacturers of trips.

Prestatyn, N. Wales. J. A. WINCHESTER.

Scientific Policy

Advisory Council's Report

IN the seventh annual report of the Advisory Council on Scientific Policy (1953–54) which was published last week (H.M. Stationery Office, price 1s net) the topics reviewed are sub-divided as follows: (1) The scale of the civil scientific research effort, including such matters as the supply of, and demand for, scientific manpower, and the provision, financial and physical, for Government scientific research. (2) The "exploitation" of the scientific effort, i.e., the extent to which the results of the effort are put to effective and practical use, both by Government and by industry.

In the first sub-division it is shown that the increase in the size of our universities, and more particularly, the increase in the numbers of graduates in science and engineering, are among the most noteworthy changes which have taken place in Great Britain during the past ten years. Over this period the Government's grants to the universities have increased from a level of £6·9 million for recurrent and nil for capital expenses to £20 million and £5·7 million, respectively. The decision to embark on this expansion was based on the Barlow Committee's recommendation that the output of scientific graduates should be doubled.

Some of the longer-term considerations advanced by the Barlow Committee remain very live issues. The Committee, sitting in the first half of 1946, estimated that the output of science graduates would have to be stepped up to not less than 5,000 per annum if supply was to catch up with demand over a period of fifteen years. It also predicted that the numbers of trained scientists would still be inadequate by 1955, and that the demand would, in fact, continue to increase for an indefinite period. As things have turned out, the number of first degrees and diplomas given in science subjects is to-day nearer 6,000 than 5,000, and that of first degrees and diplomas in technology about 3,500, as compared with 1,700 pre-war. Forecasts of the trend of future demand for trained scientists are notoriously shaky, but after reconsidering the available evidence, the Scientific Manpower Committee reported two years ago that the supply of university-trained scientists of almost all specialities was likely to be inadequate for an indefinite period.

During the course of the present year the Council have continued to hear from many quarters that the general position with respect to demand remains unchanged. It is, in fact, now commonplace for authoritative bodies, such as the Federation of British Industries, to point out how inadequate is the supply of scientific manpower on which industry can call. It is clear, therefore, that, even if it was over cautious about the possibilities of increasing the output of trained scientists, the Barlow Committee was correct in predicting that there would be a continuing shortage of these graduates.

The most important single measure which would materially increase the supply of science undergraduates would be for more boys to stay at school until the age of university entrance. In May, 1952, when the Council first referred to this matter (Cmd. 8561), they noted that only 30 per cent of the 15–16 age group remained at school in England and Wales; for the 16–17 age group the figure was 15 per cent; and the 3 per cent which went to a university was drawn almost entirely from the 7 per cent who were still at school at the age of 17–18. One point which is worth noting is that a proportion of those boys who leave school before the age of 17 to enter industry continue their scientific and technical education on a part-time basis. There is a view that, if an increase in the size of the university population were to take place at the expense of their numbers, we should all be poorer for the change, since many of these early leavers gain National and Higher National Certificates and even external degrees or membership of the professional institutions, and eventually play an important part in British industry.

Encouraging more boys to stay on at school until university age is, in any event, only one part of the problem. Every bit as serious is the continuing decline in the numbers and quality of science teachers. Just how serious the position is is revealed by a sample survey of the staffing of 66 grammar schools in the north-west of England which has just been published. As judged by basic academic qualifications, this survey shows that the quality of science teachers in grammar schools is falling fast, whereas the proportion of highly qualified arts graduates in the teaching profession is being maintained in spite of the greater intake of staff into the schools. The proportion of arts graduates with first and second class honours degrees has, in fact, risen from about two out of five in teachers born before the year 1900, to nearly four out of five in teachers born after 1920. Against this, only two out of five new science or mathematics teachers to-day have First or Second Class Honours Degrees.

Relatively speaking, the United Kingdom has probably done more to increase the scale of science education since the war than any other major Power. On the other hand, it is also clear that we had a stronger need than most to undertake this educational programme, partly because of the leeway we had to make up, and partly because the maintenance of our present standard of living constitutes a more severe challenge than has to be faced by almost any other country. Organizations such as the Federation of British Industries are doing much to publicize the facts of our situation.

Dr. J. H. Mitchell

Mr. P. R. Dunn

Mr. G. W. B. Mitchell

Mr. W. A. Crocker

Professor E. Bradshaw

I.E.E. Centre Chairmen

Men who will Preside over the Provincial Meetings

IN our issue of 3rd September we published the portraits and biographical notes of the chairmen for 1954–55 of the specialized Sections of the Institution of Electrical Engineers. In the following notes we give similar particulars of the chairmen of some of the provincial Centres, and hope to deal with the remainder in subsequent issues.

MR. J. H. MITCHELL, Ph.D., B.Sc., chairman of the East Midland Centre, was a research student at Bristol University, and later became a research engineer with the British Thomson-Houston Co., Ltd., Rugby. During the war he was a member of the Scientific Research Pool for the Air Ministry, the Ministry of Aircraft Production and the Ministry of Supply and carried out research on radar. He has also carried out research on v.h.f. communication and radio aids to navigation. Later he was with the Operational Research Section, Coastal Command Instrumentation. Dr. Mitchell was appointed to his present position of head of research with Ericsson Telephones, Ltd., Nottingham, in 1947.

MR. P. R. DUNN, B.Sc. (Mersey and North Wales), is deputy chief engineer of British Insulated Callender's Cables, Ltd. He was educated at King Edward's School, Birmingham, and after practical mechanical training with R. T. Shelley, Ltd., Birmingham, he studied electrical engineering at Birmingham University, gaining the degree of B.Sc., with first-class honours. In 1925, Mr. Dunn joined British Insulated & Helsby Cables, Ltd., serving for some years as a construction engineer on the installation of mains cables at home, and of overhead equipment for railway electrification in India. This was followed by a period of investigation and development work on high voltage cables and on factory processes. In 1932 he was appointed sales engineer of the company's Manchester area and in 1939 became assistant to the chief engineer of the then British Insulated Cables, Ltd. After the formation of British Insulated Callender's Cables, Ltd., in 1945 he was engaged largely in technical liaison matters, receiving his present appointment in 1952.

MR. G. W. B. MITCHELL, B.A.(Cantab.), (North-Eastern), was educated at Oundle School, Northants and Jesus College, Cambridge, where he took the Mechanical Science Tripos. On leaving Cambridge he went to Australia, joining the State Electricity Commission of Victoria, first in the Test Department and subsequently in the Department concerned with system planning and design. On leaving the State Electricity Commission, Mr. Mitchell joined Merz & McLellan at their London Office in 1929, and was concerned initially with the preparation of schemes and estimates for the S.E.E., M.E.E., and N.E.E. areas of the Central Electricity Board's system. He has since been associated with every electrical aspect of the extensive works which the firm has undertaken, with particular interest in protection problems.

MR. W. A. CROCKER (North Midland), is manager of the York Sub-Area of the North Eastern Electricity Board. He received his technical education at the Bradford Technical College and was a trainee for two years with the Bradford Corporation Electricity Department. He was then appointed assistant substations engineer and later assistant electrical construction engineer and in 1931 left Bradford to become technical assistant at West Ham, thereafter holding the appointments of substations engineer at Plymouth, technical assistant to the Stretford and District Electricity Board, deputy borough electrical engineer of Birkenhead and city electrical engineer of York.

PROFESSOR E. BRADSHAW, M.B.E., Ph.D., M.Sc.Tech. (North-Western Centre), is head of the Electrical Engineering Department in the Faculty of Technology, Manchester University. He was formerly with the British Thomson-Houston Co., Ltd., and at the Royal Technical College, Glasgow. Prof. Bradshaw has organized several courses for Divisional and Area Board engineers at the British Electricity Authority's residential training centre, Electricity Hall, Buxton. During the war he was engaged in the organization, particularly of laboratory work, for the large schemes of training for Service personnel, under the direction of the late Professor Parker Smith, at the Royal Technical College, Glasgow. He has participated as lecturer and tutor in most of the Ministry of Education Engineering Summer Schools since the war. Prof. Bradshaw is the founder and editor of "Bulletin of Electrical Engineering Education." He is the author of a book "Electrical Units" and of an I.E.E. paper on M.K.S. units.

Institute of Welding

THE annual meeting of the Institute of Welding will be held in London from 27th to 29th October. The programme is as follows:—

Wednesday, 27th October: Annual dinner at Park Lane Hotel, Piccadilly, London, W.1 (tickets: members, 31s 6d; guests, 2 guineas).

Thursday, 28th October: Presidential address by Mr. R. G. Braithwaite, M.I.C.E. Presentation of the C. W. Hill Prize (1953). Presentation and discussion of "A New Process of Stud Welding," by W. P. van den Blink, E. H. Ettema and Dr. P. C. van der Willigen; "The Automatic Argon Arc Welding of Low Alloy Steel Sheet," by F. J. Wilkinson; "The Twin Argon Welding Process," by J. A. Donelan.

Friday, 29th October: Presentation and discussion of the following reports of the B.W.R.A. "Vanadium as Replacement for Molybdenum in Low Alloy Steels," by C. L. M. Cottrell and B. J. Bradstreet; "Weldability of a B-Mo Steel related to the Properties of the Heat-affected Zone" and "Weldability of Mn-Mo Steel Related to the Properties of the Heat-affected Zone," by C. L. M. Cottrell. The discussion meetings will be held at the Institution of Civil Engineers, Great George Street, Westminster, S.W.1.

INDUSTRIAL NEWS

Electric Traction Equipment for Australia

The New South Wales Government, Department of Railways, has placed an order with the Metropolitan-Vickers Electrical Co., Ltd., through its associate company, Australian General Electric Pty., Ltd., for sets of electric traction equipment. These are for multiple-unit rolling stock (80 motor coaches and 80 trailers) being built for the Sydney suburban and inter-urban railways. Forty sets will be used on trains running on the new electrification between Sydney and Lithgow, over the steep gradients of the Blue Mountains. The value of the order is well over £1,000,000 sterling. The equipment will be designed by the Metropolitan-Vickers Electrical Co., and will be manufactured partly at the M-V works at Sheffield and Manchester and partly at the A.G.E. works at Auburn, N.S.W. The Metropolitan-Vickers Co. has supplied 530 sets aggregating over half a million horsepower for the Sydney suburban lines since 1925, and it has forty 3,780 h.p. locomotives in hand for the Blue Mountains electrification.

Display of domestic appliances on the stand of the English Electric Co., Ltd., in the British Pavilion of St. Erik's Fair, Stockholm, which closes on Monday next. Since its opening on 28th August the Fair has been visited by some 40,000 people daily

Television in Australia

The Australian Federal Cabinet decided last week to establish national and commercial television services as soon as possible. The first stations will be at Sydney and Melbourne and the system will later be extended to other State capitals. The Postmaster-General announced that tenders for the equipment for the Sydney and Melbourne national stations would be called for immediately.

Vehicle Headlight Dazzle

Various ways of eliminating headlight dazzle, such as improvement in the aiming of headlamps, illumination of inefficient lamps and the adoption of a single design of lamp for all vehicles, are discussed in Road Research Technical Paper No. 32, "Vehicle Headlighting Visibility," which has been issued by the Department of Scientific and Industrial Research, H.M. Stationery Office, price 2s. While the paper does not discuss forms of lighting other than the conventional type, it concludes that as the improvement which this type offers appears to be limited, the possibilities of employing radically different systems such as polarized light will have to be seriously considered.

Scottish Industries Exhibition

In addition to the companies mentioned in our last issue, the Carron Co. is exhibiting at the Scottish Industries Exhibition its "Curtsey" electric fire and the "Cameo" and "L.2" electric cookers.

Aircraft Electrical Equipment School

The Vacation School of the Electrical Engineering Department of the Imperial College of Science and Technology will this year take the subject of "Aircraft Electrical Equipment" and will be held on the five days 20th to 24th September.

The School will commence at 10 a.m. on Monday, 20th September, when Sir Frederick Page, C.B.E., Hon. F.R.Ae.S., F.C.G.I., will deliver an opening address. This will be followed by an introductory survey by Mr. D. F. Welch (British Thomson-Houston Co., Ltd.). Lectures in the programme include "Power Systems," by J. H. Rea, B.Sc.(Eng.); "Brushwear Problems and Vibration Problems," by R. F. Sims, B.Sc.(Eng.); "D.C. Machines," by B. Adkins, M.A., M.I.E.E.; "Electrical Installation Engineering," by H. Zeffert, A.F.R.Ae.S.; and "A.C. Machines," by W. Philipp, B.Sc.

A visit will be paid to the works of Vickers-Armstrong, Ltd. The fee for the School is eight guineas and full particulars may be obtained from the organizing secretary of the school, Mr. B. John Prigmore, Electrical Engineering Department, Imperial College of Science and Technology, City and Guilds College, Exhibition Road, London, S.W.7.

Norway's Electrical Trade

Norway's electrical import trade last year totalled Kr. 278 m. in value, an increase of about Kr. 34 m. on 1952. Outstanding among the advances were generators and cable. West Germany headed the list of supplying countries with a contribution valued at just over Kr. 95 m., followed by Great Britain (Kr. 60,454,000), Sweden (Kr. 41,106,000), and Denmark (Kr. 21,524,000). The chief items, with notes of increases or decreases, are shown below. Norway's exports of electrical machinery and apparatus in 1953 were valued at nearly Kr. 14 m. of which Kr. 1,963,000 represented cable and wire; Kr. 1,458,000 radio telegraphic, etc., material; Kr. 1,332,000 transformers and Kr. 1 m. radio receiving sets.

Class of Equipment	1953 Kr.(000)	Inc.or dec. on 1952 Kr. (000)
Electric motors	51,969	− 382
Generators	26,457	+ 10,549
Transformers	11,984	− 3,560
Convertors, etc.	11,043	+ 4,922
Batteries and parts	5,081	+ 1
Accumulators and parts	4,119	+ 636
Incandescent lamps	9,045	+ 3,745
Radio apparatus and parts	1,921	*
Radio valves	2,417	− 1,437
Radio telegraphic, etc., material	7,961	− 1,693
Automatic telephone apparatus, etc.	6,044	+ 720
Lead covered cable up to 40 mm diam.	6,759	+ 1,635
Ditto, 40 to 80 mm diam.	4,266	+ 1,173
Ditto, over 80 mm	97	+ 47
Other electrical wire	6,311	+ 497
Vacuum cleaners	5,458	+ 396
Porcelain insulators, h.v.	3,688	− 1,794
Ditto, l.v.	2,322	− 169

* Comparative figures not available.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £156 0s 0d
COPPER, H.C. Electro	ton £247 10s 0d
Fire Refined 99·70%	ton £246 0s 0d
Fire Refined 99·50%	ton £245 0s 0d
COPPER Tubes	lb 2s 4½d
Sheet	ton £308 5s 0d
H.C. wire and strip	ton £277 10s 0d
LEAD, English	ton £100 15s 0d
Foreign	ton £99 0s 0d
MERCURY	flask £102 0s 0d
TIN, block (English)	ton £738 10s 0d
ZINC, G.O.B. Foreign	ton £81 10s 0d
Electrolytic	ton £84 18s 0d
BRASS Tubes (solid drawn)	lb 1s 11½d
Sheet	ton £252 5s 0d
Wire	lb 2s 6½d
PHOSPHOR BRONZE Wire	lb 3s 10½d
PLATINUM	oz £30 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 20¾d–21d

Smoke Abatement Conference

The annual conference of the National Smoke Abatement Society will be held at Scarborough from 22nd to 24th September.

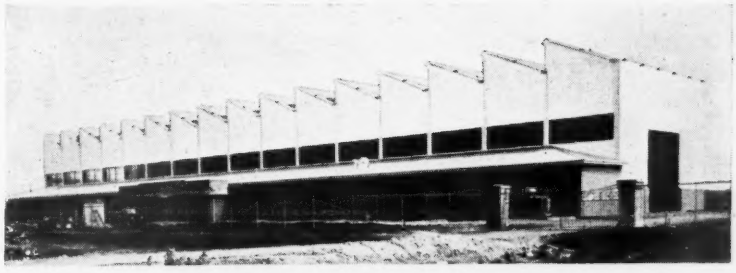
Nearly 500 delegates and members, representing local authorities, Government departments, the fuel and power industries, manufacturing interests, the railways, and technical organizations, will be present. The Presidential Address will be on "The Coal Crisis—and the Society," by Sir Ernest Smith. More technical aspects will be reviewed in papers on the industrial uses of gas and electricity. The paper on electricity will be read by Mr. J. I. Bernard, chief technical officer of E.D.A. Mr. R. F. Harvey, chief officer, motive power, British Railways, is to give a paper reviewing the efforts being made to reduce smoke from steam locomotives and developments in smokeless forms of traction. The conference is open to all who may wish to attend and details can be obtained from the Society at 30, Grosvenor Place, London, S.W.1.

Food Fair

Automatic cooking is one of the main attractions at the 1954 Food Fair which, until to-morrow, is being staged at Olympia, London. On the stands of the British Electrical Development Association daily demonstrations of "absent control" in cookery are being given by Miss Marguerite Patten, B.B.C. television cookery expert, and each day there is the ceremony of the "unsealing" the electric cooker in which a complete menu has been cooking entirely without supervision. Between demonstrations the new E.D.A. film "Bride and Prejudice" is being shown on an adjoining stand.

Another feature of the E.D.A. display is the coffee bar, which includes a selection of almost all the various makes of electric coffee percolators and appliances. As coffee is served here, use is made of the "Dishmaster" and "Wastemaster" dish washing and sink units, which form part of the kitchen. A cooker designed for blind housewives, with Braille markings on the controls, and bell signal in place of pilot light, is also shown.

The recently introduced English Electric "EA.83" refrigerator and the company's food mixer are being used in demonstrations given by Alfred Bird & Sons. Kenwood Electrics, Ltd., are displaying their range of electric food mixers which meet almost every kitchen need and demonstrations are continually being given of the new "Steam-o-Matic" dual-purpose steam or dry iron. On the commercial side can be seen the "Sortex" electronic apparatus, shown by R. W. Gunson (Seeds), Ltd., which utilizes a photo-electric cell in conjunction with electrostatic separation. One model continually sorts haricot beans while the other is available for demonstrations of any product requiring colour separation.



The new works at Whyalla, South Australia, of C. A. Parsons of Australia, Ltd.

C. A. Parsons' Australian Works

The new works of C. A. Parsons of Australia, Ltd., at Whyalla, South Australia, are to be formally opened on 27th September by the Hon. Thomas Playford, Premier of South Australia.

The first Parsons turbo-generator installed in Australia had an output of only 120 kW and was supplied in 1896 to the Victorian Railways Commissioners, Williamstown. Since that time over two million kW of Parsons generating plant have been installed in, or are on order for, Australia, and the size of individual machines has increased to an output of 60 MW. The increasing demand for generating plant in Australia led C. A. Parsons & Co., Ltd., Newcastle-upon-Tyne, to establish a works in that country to manufacture condensing and feed heating plant for installation and operation in conjunction with steam turbo-generators manufactured at Heaton Works and shipped to Australia. A site at Whyalla was chosen and a company was formed under the title of C. A. Parsons of Australia, Ltd.

The site is situated on the Port Augusta road and has a total area of 50 acres. The first section of the factory comprises a single bay 400ft by 60ft with an annexe 25ft wide housing the administration offices, drawing office, mess rooms and store rooms. The bay is equipped with a 30-ton overhead travelling crane, and all necessary machine tools to undertake the work initially to be carried out there. The site has been laid out and provision made in the building structure for expansion to the north and to the west as that becomes necessary.

Part of the E.D.A. stand showing the range of automatic electric cookers

New Instrument Company

A new company has been formed in this country, with the title of Called Giannini, Ltd., which is an affiliate of G. M. Giannini & Co., Inc., the American instrument and control manufacturers of New York. The new company intends to negotiate licences for the manufacture of equipment to Giannini designs for the British Commonwealth and Empire, excluding Canada. The directors are Mr. C. Dykes, who has been United Kingdom adviser to G. M. Giannini & Co., Inc., for the past two years, and Mr. B. Sutton, of Frere, Cholmeley & Nicholsons, solicitors. Inquiries should be sent to Mr. Dykes, at 31, Pembroke Gardens, London, W.8 (telephone: Western 9493).

Learn to do it Yourself

Like most things, replacing a fuse and rewiring a plug top are both simple jobs when you have had just a little practice. Most women, however, do not want to tackle the job for the first time when, say, the lights go out and they are alone in the house. That is why in the past two Autumns many women in London have welcomed the courses in simple electrical housecraft organized by the Electrical Association for Women at its headquarters, 35, Grosvenor

Place, London, S.W.1. A course of three classes will again be held on Wednesday evenings, 3rd, 10th and 17th November. Application should be made to the Association, and the fee is 2s 6d.

E.A.W. Awards

The E.A.W. Diploma in Electrical Housecraft for Demonstrators has been awarded to Mrs. Bairstow, Eastern Electricity Board, Friern Barnet; Miss B. P. Palmer, Eastern Electricity Board, Woodbridge; and Mrs. J. Best, Yorkshire Electricity Board, Leeds. The E.A.W. Diploma for Teachers was awarded to Miss Elsie M. Reed, Wolverhampton and Staffordshire College, Wolverhampton, who gained a first class pass. To date 473 diplomas have been awarded to demonstrators, and 93 to teachers.

The fifth E.A.W. Examination for Electrical Sales Assistants was held on 18th May, when thirty-two candidates qualified for the certificate, five gaining distinction. The total number of certificate holders is now 149.

The Certificate Examination for Teachers was held on 19th June when 67 candidates qualified for the certificate, two gaining distinction. The total number of certificate holders is now 1,917.

The Certificate Examination in Electrical Housecraft for Demonstrators and Saleswomen was held on 17th June when 80 candidates qualified for the certificate, six gaining distinction. The total number of certificate holders is now 2,154.

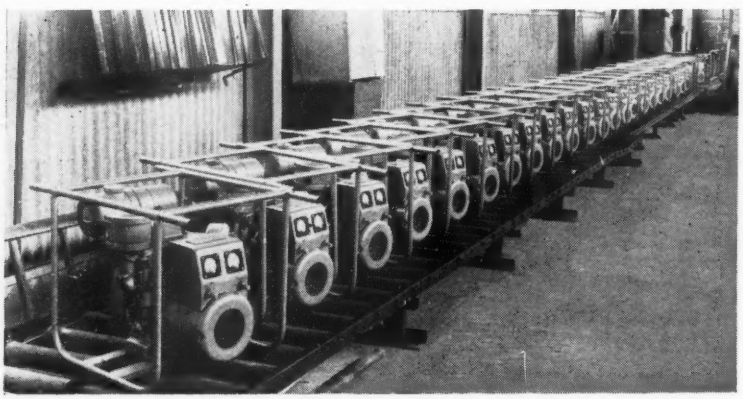
Owen Falls Contractors' Plant

The Owen Falls Construction Co., of Jinja, Uganda, has appointed George Cohen Sons & Co., Ltd., as sole selling agents for the disposal of the large quantity of civil engineering plant used for the construction of the Owen Falls hydro-electric scheme.

Generators for Export

The accompanying picture shows part of the production line of the Dale Electric (Yorkshire), Ltd., of a few generators, part of a large batch which the company is manufacturing for an overseas Government. These plants comprise a Villiers Mark 15 engine, monobloc coupled to a 500 W 12/15 V battery charging generator and, as can be seen, they are fitted with a fully-instrumented switchboard, which incorporates voltmeter, ammeters, battery cut-out and connection terminals, etc. They are fitted into a tubular steel frame with four detachable lifting handles.

Generators for dispatch overseas on the production line at the works of the Dale Electric (Yorkshire), Ltd.



Metro-Vick in Brazil

The first building of the Belo Horizonte factory of Metrovick do Brasil (Eletricidade) Limitada, a subsidiary of the Metropolitan-Vickers Electrical Co., Ltd., was officially opened recently by Dr. Juscelino Kubitschek, Governor of the State of Minas Gerais. The main purpose of this factory is to carry out heavy maintenance work for the Central Railway of Brazil, the Rede Mineira de Viacao, and for other electrified lines in Brazil. That country has had a large amount of Metropolitan - Vickers electrical equipment in service for many years, and twenty-four new electric locomotives have recently been put into operation. In addition a large contract was signed in the early part of this year, covering the supply of a hundred motor coaches, a similar number of trailer coaches and a further hundred sets of electrical equipment for trailer coaches to be built in Brazil. This material is destined for the Rio de Janeiro suburban lines. Dr. I. R. Cox, managing director of the Metropolitan-Vickers Electrical Co., Ltd., thanked the Governor for his presence and in reply Dr. Kubitschek said that they were inaugurating a factory that would be of the very greatest use to transportation in Brazil. At the conclusion of the ceremony the Governor gave an official luncheon in Dr. Cox's honour, and in the evening Dr. and Mrs. Cox received some 250 guests at a cocktail party.

The entrance of the new Metropolitan-Vickers traction repair factory at Belo Horizonte, Brazil

Trade Announcements

The Midlands Office of **Pyrotenax, Ltd.,** has moved to new premises at Martins Bank Chambers, 140/141, Broad Street, Birmingham, 15 (telephone: Midland 1265). The new offices will have a fully equipped demonstration and instruction department.

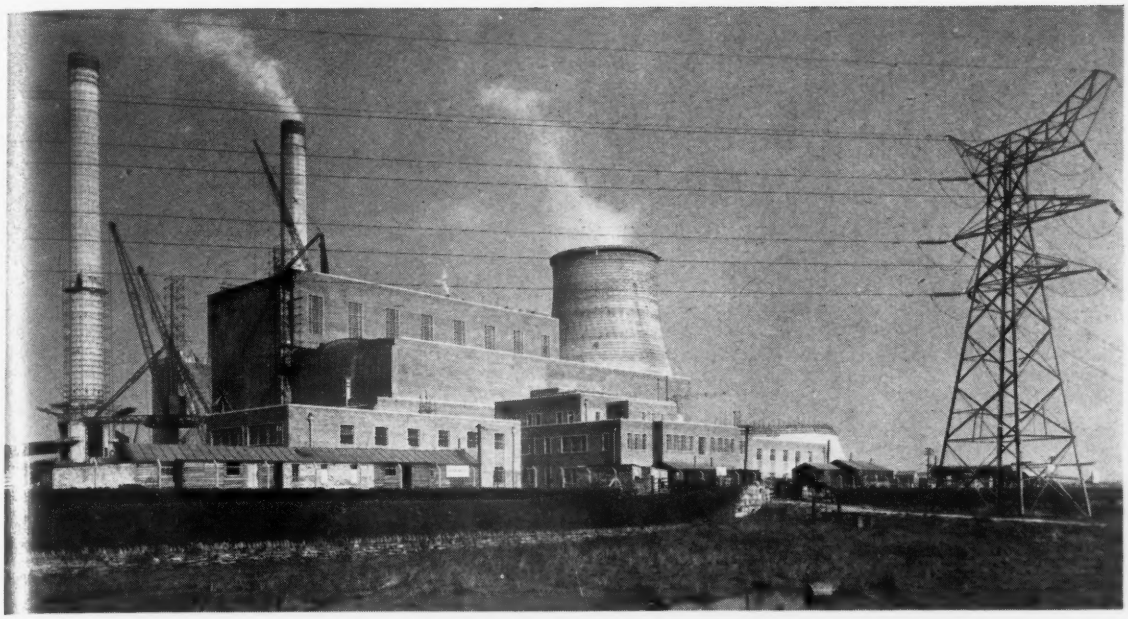
Mr. C. A. Smith, 14, Meeting House Lane, Ulverston, Lancs., has been appointed by **FitzGibbon & Murray, Ltd.** to represent them in Northern England for Cumberland, Durham, Westmorland and the North Riding of Yorkshire.

From to-morrow, Saturday, the head office and works of the **Wandsworth Electrical Manufacturing Co.** will be Albert Drive, Sheerwater, Woking, Surrey (telephone: Woking 3506). There will be a sales office, stores and distribution organization at 90, Vittoria Street, Birmingham (telephone: Central 8581), and a London sales office at 136, Cromwell Road, Kensington, S.W.7 (telephone: Fremantle 6301/2).

A new London showroom for "Paladin" electric food mixers and blenders has been opened by **Barclay & Sons, Ltd.,** at 28, Old Brompton Road, Kensington, S.W.7. Mr. J. E. H. Fildes Moss has been appointed sales manager for national distribution. The apparatus on show includes a new "Paladin," made in three models, incorporating several new features.

Strike Ended

After a nine days' strike over wages, 160 women employed at the Hartlepool (Durham) factory of Siemens Brothers & Co., Ltd., have returned to work. The women contended that the use of plastic covered wire for wiring automatic telephone equipment, in place of fabric covered wire, would reduce their earnings. The company, however, denied that the girls' earnings would be adversely affected, but refused to discuss the matter until the strikers returned to work. The subject is being considered by the E.T.U. and the employers.



Connah's Quay Power Station

Official Opening by Lord Citrine

THE building of the Connah's Quay generating station of the Merseyside and North Wales Division of the B.E.A. on the Dee Estuary was originally envisaged by the Chester City Council with a view to replacing the existing small station at Queensferry. It was proposed that it should have a capacity of 60 MW, but when the B.E.A. took over the project it was decided that a larger station was required to meet the increasing electrical load in the North Wales area. The ultimate capacity of the station, which was officially inaugurated yesterday (Thursday) by Lord Citrine, chairman of the B.E.A., will be 180 MW. The general design is on the unit principle, there being six 30 MW turbo-alternators and six 300,000 lb/hr boilers, together with the necessary switchgear, coal and ash plant, circulating water pumps, cooling towers and general auxiliary plant.

The site covers 200 acres about a mile north-west of Connah's Quay, being bounded on the north by the River Dee and on the south by the main Chester–Holyhead railway. The first stage of the construction necessitated reclaiming about 70 acres of salt marsh to accommodate the power station with its cooling towers, outdoor grid substation and coal storage area. Messrs. Mouchel & Partners are the civil engineering contractors for the station and the river intake works.

The majority of the works are carried upon 14in square precast concrete piles the lengths of which vary between 15 and 30ft. Great difficulty was experienced in driving some of the piles the required minimum length, particularly under the turbo-alternator blocks and circulating water culverts. The maximum load on each pile is 60 tons and the spacing generally about 3ft.

The building is of steel framed, brick clad construction, the main stanchions and roof girders being in 28ft bays. The complete building is about 390ft long by 236ft wide by 130ft high with two chimneys, each 300ft high and 16ft clear diameter, sitting on 58ft high reinforced concrete stools which are cased in brickwork. There will be three reinforced concrete cooling towers each 250ft high, 238ft in diameter at the bottom and 110ft diameter at the rim. They are constructed upon a common pond which can be divided to permit the operation of one half of any tower. This pond is 6ft 3in deep and holds about 8¼ million gallons of water.

The generating plant comprises six 30 MW Parsons turbo-alternators with an economic rating of 24 MW. The turbines are twin-cylinder machines with a duplex exhaust and are of the reaction type running at 3,000 r.p.m. The operating steam conditions are 600 lb/sq in and 850 deg F at the stop valve. From the last stages of the l.p. cylinder the steam is exhausted to a three pass surface type condenser capable of maintaining a vacuum of 28·7in of mercury when the turbine is operating at its economic continuous rating, the cooling water inlet temperature being 65 deg F and the outlet temperature 87·5 deg F.

There are two electrically driven extraction pumps each capable of handling the full quantity of condensate. Two 100 per cent duty steam operated multi-stage air ejectors are provided for maintaining vacuum in the condenser, together with one single-stage quick start ejector which will create a vacuum of 20in of mercury in the condenser in 4 min.

Four feed water heaters are provided and utilize bled steam from the turbine at pressures of 154, 58·2, 15 and 5·1 lb/sq in absolute—these being the conditions for maximum load on the turbo-alternators. The final feed

water temperature leaving the No. 2 h.p. heater is 345 deg F. The boiler feed pumps are between the second and third feed heater, a shunt de-aerator being fitted to ensure a supply of de-aerated water for make-up.

The alternator is of the three-phase totally enclosed ventilated type and is connected directly to the rotor of the turbine through a multi-claw semi-flexible coupling. It is excited by its own exciter directly driven from the alternator shaft. The alternator cooling is by means of a closed air system, the air being circulated by two motor driven fans.

Steam Raising Plant

Ultimately there will be six International Combustion pulverized fuel fired Lopulco water tube type boilers each with a steaming capacity of 300,000 lb/hr at 625 lb/sq in and 865 deg F. The complete steam raising unit including the economizer and air heater is supported on structural steelwork which is carried from the basement level completely independent of the building structure. Automatic boiler control equipment is provided to control the supply of fuel, steam pressure, air for combustion and furnace pressure. Each boiler will be provided with two forced and two induced draught fans, the former drawing air from above the boiler inside the boiler house to provide a measure of reclaimed heat. From the boiler the flue gases pass to a Sturtevant electrostatic precipitator arranged in two independent sections thus enabling one half of the plant to be shut down for maintenance. Each precipitator is equipped with its own high voltage house and rectifying equipment. From the precipitator the gases pass to the induced draught fans and are then discharged to the main flue and chimney.

Some 10,000 tons of coal a week will be consumed at the power station when it is completed. Sidings have been provided to deal with supplies brought in by rail wagons and in addition roadborne coal can be accommodated. Inside the boiler house, coal is discharged into small hoppers which feed two shuttle conveyors which are capable of serving the three hoppers of each of the boiler bunkers.

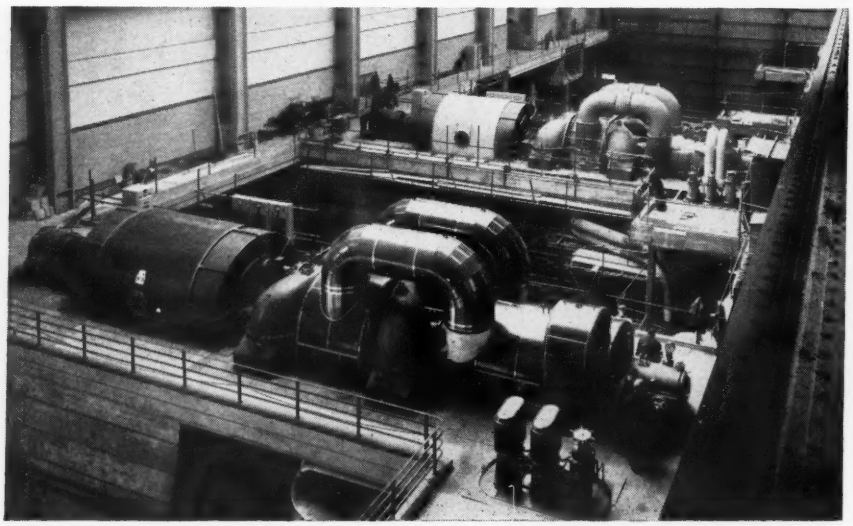
From the bunker outlets coal is fed through chutes down to the Lopulco coal grinding mills of which there are three for each boiler. Each mill has its own exhauster fan which is designed to deliver the coal laden air to each of the burners via a system of fuel piping. There are fou pulverized fuel burner boxes, one in each corner of th combustion chamber, and each one is complete with thre burners so that, by means of tangential firing, high tur bulence is obtained in the furnace.

General view of the auxiliary switchgear house

Each boiler turbine unit has a Harland Engineerin electrically driven feed pump capable of pumping 330,00 lb/hr of water against a pressure of 880 lb/sq in. Sigmund steam driven feed pump capable of the sam duty is installed with each unit as stand-by and is arrange to start automatically at a predetermined reduction in th feed pressure delivered to the boilers. The exhaust steam from the turbine is normally passed into the No. 2 low pressure heater of the associated main turbine. Relief valves are fitted, however, to exhaust to atmosphere.

The ash and dust discharges from the respective hoppers at the bottom of each boiler and precipitator into sluiceways which run lengthways throughout the station under the hoppers, each sluiceway accommodating three boilers. These sluiceways join into a common sluiceway on the centre line of the station from which discharge is made into a swirl pit 15ft below ground level. There are two 115 h.p. Gwynnes sluice pumps each capable of pumping 3,300 gal/min, one pump being sufficient to sluice the ash and dust discharged from the station boilers if ashing and dusting is done intermittently.

The turbine room showing No. 1 turbo-alternator completed and No. 2 in final stages of construction



From the swirl pit three separate valves are fixed for the suction pipes to each of the three 150 h.p. Gwynnes ash slurry pumps. These are each capable of discharging the slurry at a rate of 3,000 gal/min through their respective 12in bore pipelines to the top and commencing point of an open culvert 36ft above ground level from which the slurry proceeds down to the ashing area.

To condense the exhaust steam from the turbines each turbo-alternator requires 19,500 gal/min of water to pass through its condenser. Water is drawn from the cooling tower ponds via twin open

rectangular culverts, which connect to the circulating water pump house. Six Sigmund pumps each having a capacity of 21,000 gal/min discharge to twin ducts which run underneath the whole length of the turbine house. Each condenser has an inlet connection from each of the ducts and an outlet connection into each of the two discharge ducts which return the water to the cooling towers. Supplies of make-up water for the cooling towers and for the ash and dust sluice water are drawn from the River Dee by three Gwynnes vertical pumps each having a capacity of 4,000 gal/min.

To eliminate slime forming growths in the condenser tubes and the growth of marine organisms in the circulating water system, a Wallace & Tiernan chlorination plant is installed, which has a maximum capacity of 3,000 lb of chlorine for each 24 hr continuous rating, and is designed to operate intermittently under the control of a central programme clock. The boiler feed water, which is received from the town main, is purified in a Permutit mixed bed "Deminrolit" plant. The capacity of the plant is 144,000 gal of treated water in 24 hr, the normal treatment rate being 9,000 gal/hr and the reduced treatment rate, with one section out of service, 5,700 gal/hr.

The generators are connected to the 132 kV system through 36 MVA 11·8/132 kV Parsons generator transformers in the 132 kV switchgear compound. They are of the forced oil/air blast type, there being two 100 per cent coolers for each transformer, and each is fitted with on-load tap changing gear. The oil in some of the transformers will have inhibitors added, and the effect of the different inhibitors on the life of the oil and the transformers is to be the subject of research.

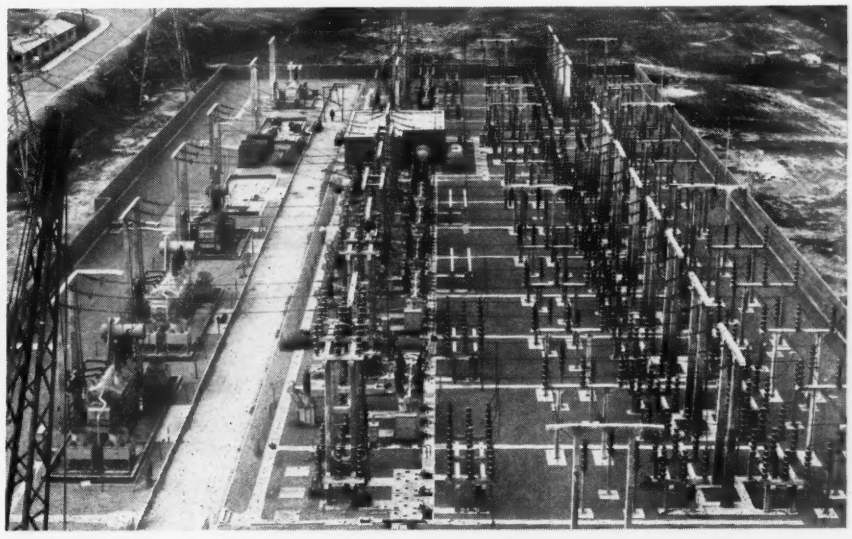
The main 132 kV switchgear was supplied by Ferguson Pailin, Ltd., and is of the bulk oil type, and has a breaking capacity of 2,500 MVA. There is accommodation for six generator units, two station transformer units, and eight feeder units, together with the usual busbar coupler and bus-section switch units.

Electrically, each turbo-alternator and boiler is operated on the unit principle, and essential supplies for auxiliaries are drawn from unit transformers directly connected to the alternators. They are in a compound under the turbine house annexe. Other station supplies and supplies to non-essential auxiliaries are obtained through 5 MVA 132/3·3 kV station transformers of the naturally cooled type. These are in the 132 kV compound. The 3·3 kV and 415 V auxiliary switchgear is of the Reyrolle air-break and switchfuse type, and is situated in annexes adjoining the turbine house and boiler house. The auxiliary transformers are of English Electric and Bonar Long manufacture.

The station is connected to the 132 kV switchgear compound by a cable tunnel, which conveys all main and multicore cables running between the station and the compound. Cables are, in general, of the paper insulated, lead covered type, supplied by British Insulated Callender's Cables, Ltd.

Separate rooms have been provided for the control panels, and for the panels mounting the station protective relays. The rooms are adjacent, and are situated in the centre of the administration block. A laylight with roof lights provides normal lighting for the control room. Cold cathode lighting mounted above the laylight provides illumination during the hours of darkness.

View of the 132 kV substation connecting Connah's Quay station with the grid system



Large Philadelphia Power Station

PLANS to construct a power station that will establish new high levels for efficiency, steam pressure and temperature have been announced by the Philadelphia Electric Company. This will call for an initial investment of some $45,000,000 and will serve the rapidly growing Delaware valley.

The 275,000 kW turbo-alternator, the largest ever ordered, will be built by the Westinghouse Electric Corporation, while the steam boiler plant will be built by Combustion Engineering Inc. The turbine steam conditions will be 5,000 lb/sq in and 1,200 deg F, although the initial operation will be at 1,150 deg F.

The tandem-compound, four-cylinder turbine will run at 3,600 r.p.m., utilizing triple-flow exhaust to the condenser, and double reheat. Both reheats will be to 1,050 deg F. All the elements of the turbine, except the super-pressure element, are of the conventional design, using ferritic materials. The first, or super-pressure, element will be designed for initial steam conditions of 5,000 lb/sq in and 1,200 deg F, exhausting at approximately 2,400 lb/sq in. The second element will combine both high pressure and first reheat pressure turbines in a common casing, while the third will combine the intermediate pressure and the single-flow low pressure turbine in one casing. The final element will be a conventional double flow low pressure turbine, exhausting to the condenser at 1·5 in Hg absolute pressure.

Steam will be condensed in a 105,000 sq ft single pass, radial flow, Westinghouse condenser. Two pumps, each of 75,000 gal/min capacity, will provide cooling water to condense the steam.

The alternator will be rated at 352,000 kVA three-phase, 60 c/s, 24 kV, 3,600 r.p.m. It will be self-ventilated with shaft mounted fans and will employ hydrogen inner-cooling of the rotor and stator conductors. Without the use of inner-cooled conductors, it would be impossible to build a 3,600 r.p.m. generator of this size. Separate motor driven generators will provide excitation for the main generator. Magnetic amplifiers will be used to regulate the terminal voltage of the generator.

Financial Section

STOCKS and SHARES

WHILE anxiety over international affairs serves at times to ruffle the surface of Stock Exchange conditions, it seems to be doing little to disturb their underlying firmness. In the industrial markets, a present influence is the practice of many companies to declare interim dividends at this season. Some of the declarations have been distinctly encouraging. Reference is made below to the International Combustion announcement, which closely followed declarations of increased interim payments from, amongst other electrical firms, the Chloride Electric, Desoutter and Telegraph Condenser companies.

Higher Prices

A rise of 3s 9d in the price of English Electrics set a good example which many other electrical engineering shares followed. Westinghouse Brakes added 3s 3d, and Tube Investments 3s 9d to previous advances. Hoovers were again outstandingly active; the company has had under consideration a capital reorganization scheme which would embrace the "A" ordinary shares. Other shares which continued in the ascendant included Lucas, Morphy-Richards, S. Smith, British Thermostat and Aberdare Cables. Dewhurst and Dictophones were each 6d to the good at 7s, and there were improvements in Veritys, Enfields, Wolf Electric, Scottish Cables and Sturtevant.

International Combustion

A rise of 4s 9d in the price of International Combustion shares, now 28s 9d, has followed the company's declaration of a 10 per cent interim dividend on account of the financial year which ends this month. It is at double the rate of last year's corresponding payment, and is unaccompanied by any of the reservations, often made on these occasions, about the implications which it may have for the year's total distribution. The market feels encouraged therefore to anticipate an improvement on the total of 20 per cent paid for 1952–53. The final declaration, together with the preliminary profits statement, appeared last time in February.

Dividend Prospects

Before the interim dividend announcement referred to above, International Combustion 5s shares had already secured a place among this year's most popular industrials. They are now little short of the distinction of having doubled in value since January. Apart from their possession of most of the normal qualifications of a "blue-chip" industrial, the shares are ranked high in the list of those calculated to benefit from the elimination of the Excess Profits Levy from the beginning of this year. The charge of £275,000 under that heading in the last accounts was considerably bigger than the net amount distributed in the 20 per cent dividend. At that

The Week's Price Changes

Company or Board	Nom. Value	Middle price 13th Sept.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1954 Highest	1954 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	95½		3	3	3 2 10	97	88⅝
Brit. Elec. 1974/77	100	95		3	3	3 3 2	96½	87½
Brit. Elec. 1976/79	100	101⅛		3½	3½	3 9 0	101½	93⅜
Brit. Elec. 1974/79	100	109		4¼	4¼	3 18 0	111½	103⅛
Overseas Electric Supply								
Calcutta Elec.	£1	24/-		6†	6†	5 0 0†	24/6	18/7
East African Power	£1	22/-	+6d	7	7	6 7 3	23/4	19/6
Nigerian Elec.	£1	24/-		10	10	8 6 8	25/-	23/6
Palestine Elec. "A"	£1	21/-		Nil	Nil	—	21/-	16/-
Perak Hydro-Elec.	£1	14/9	−3d	Nil	6	8 2 8	16/-	13/9
Equipment and Manufacturing								
Aberdare Cables	5/-	12/6	+6d	25	12½†	5 0 0	12/6	8/1
Aerialite	1/-	13/9		88⅛	88⅛	6 8 6	14/-	10/9
Allen, W. H.	£1	76/3		15	20	5 5 0	76/3	50/-
Aron Elec. Ord.	£1	53/9		20	15	5 11 6	53/9	43/-
Assoc. Elec. Ord.	£1	60/9		20	11¼*	3 14 0	61/6	41/6
Automatic Tel. & El.	£1	72/6		15	15	—	73/-	57/3
Babcock & Wilcox	£1	62/6	+3d	18	12*	3 16 9	62/3	47/3
Baldwin, H. J.	2/-	4/6		20	20	8 18 0	5/6	3/9
Bakelite	10/-	26/3		12½	12½	4 15 3	27/6	23/6
British Aluminium	£1	35/9	+9d	12	10	5 12 0	40/-	33/9
B.I. Callender's	£1	47/6	−3d	10	10	4 4 3	48/-	37/9
B.I. Callender's 6% Pref.	£1	26/6		6	6	4 11 6	26/6	24/3
British Thermostat	5/-	26/3xd	+1/6d	35	27½*	—	26/3	12/-
British Vac. Cleaner	5/-	13/6		25	25	9 5 3	14/6	11/6
Brook Motors	10/-	50/-		20	20*	4 0 0	50/-	33/3
Brush Ord.	5/-	7/-		4	6	4 2 9	7/6	3/6
Bulgin, A. F.	1/-	3/6		30	30	8 11 6	3/7	3/2
Burco	5/-	17/6	+6d	35	35	5 0 0*	17/6	12/1
Chloride El. Storage	£1	65/-xd	—	20	12½*	3 17 0	68/-	46/6
Clarke Chapman	£1	72/6		17½	20	—	73/-	47/6
Cole, E. K.	5/-	33/9	−1/3d	25	27½	—	38/9	22/6
Cossor, A. C.	5/-	9/6xd	−6d	10	10	5 5 3	11/-	7/-
Crabtree	10/-	28/9		17½	17½	6 1 9	29/6	23/9
Crompton Parkinson Ord.	5/-	19/6		11¼	20	5 2 7	19/6	14/-
De La Rue	5/-	19/-	+3d	Nil	20	5 5 3	21/-	12/3
Decca	4/-	43/3		150	35*	—	43/6	32/-
Desoutter	5/-	22/6xd	—	18	20	4 9 0	22/6	16/1
Dewhurst	2/-	7/-	+6d	19	19	5 8 6	6/6	5/1
Dictograph Tel.	2/-	7/-	+6d	20	20*	5 14 3	6/6	5/2
Dubilier Condenser	1/-	5/9		25	25	4 7 0	6/-	4/1
E.M.I.	10/-	23/-	+1/-	12	8	3 9 7	23/-	11/3
Electrical Components	5/-	15/-		20	20	6 13 4	15/-	10/9
Elec. Construction	£1	62/-	+9d	15	15	4 16 0	62/6	53/-
Enfield Cable Ord.	£1	25/9	+6d	5	Nil	Nil	25/6	16/6
English Electric	£1	58/9	+3/9d	15	10*	3 8 0	59/-	38/-
English Electric 3½% Pref.	£1	16/9xd	—	3½	3½	4 9 7	16/9	15/3
Ericsson Tel.	5/-	26/6		22†	25†	2 7 2*†	28/6	22/9
Ever Ready	5/-	26/-		35	40	—	26/3	17/9
Falk Stadelmann	£1	40/-	−6d	15	15	7 10 0	41/-	36/6
G.E.C. Ord.	£1	52/-	−6d	11½	12½	4 16 2	53/-	37/6
G.E.C. 6½% Pref.	£1	27/-		6½	6½	4 16 3	27/3	26/6
General Cables	5/-	17/3		30	30	8 14 0	17/3	16/3
Greenwood & Batley	£1	51/3		17½	17½	6 16 6	51/3	40/3
Hackbridge Cable	5/-	15/3xd	—	20	20	6 11 3	15/9	11/3
Hackbridge & Hewittic	5/-	22/6		20	25	5 11 0	23/3	16/10
Hall Tel. Acc.	10/-	13/-		10	10	7 13 10	13/-	10/6
Heatrae	2/-	5/-		12½	12½	5 0 0	5/-	4/-
Henley's	10/-	20/3		10½	10½	5 7 0	20/3	15/6
Holophane	5/-	16/9		20	20	5 19 6	17/-	13/1

* After capital bonus. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

rate, the yield on the shares is only 3½ per cent, which measures the degree of confidence in something better to come in due course.

No particular significance was read into the decision by Associated Electrical Industries to make a slight increase in the interim dividend on account of the current year. Last year's interim of 7½ per cent was paid before the 100 per cent share distribution, and would be equivalent therefore to 3¾ per cent on the present ordinary capital. In paying 4 per cent this time, the company is thought merely to be rounding off the fraction. At the same time, the quotation of the shares on a yield basis of only 3¾ per cent suggests hopes of an improvement sooner or later in the last well-covered total of 11¼ per cent. A similar position exists in the shares of C. A. Parsons, who are also making a fractional increase, following a share-for-share distribution, in this year's interim payment. Reyrolle's 6¼ per cent interim is at the same rate as before.

in Electrical Investments

Company or Board	Nom. Value	Middle price 13th Sept.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1954 Highest	1954 Lowest
Equipment and Manufacturing—continued.						£ s d		
Hoover	5/-	49/3	—	25	45	4 10 6	51/-	26/3
I.C.I.	£1	38/3	+6d	13	15	3 18 3*	39/-	26/6
Intl. Combustion	5/-	28/9	+4/9d	15	20	3 9 4	28/9	14/6
Johnson & Phillips	£1	51/3	−1/3d	15	15	5 17 0	52/6	47/6
Lancashire Dynamo	£1	58/-xd	—	12½	14	4 15 9	59/6	43/-
Laurence, Scott	5/-	22/6	−1/3d	15	20	4 9 0	25/-	14/-
Lister R. A.	£1	45/-	+1/-	9	12	5 6 8	45/-	31/9
London Elec. Wire	£1	51/3	−9d	15	10*	3 18 0	51/3	38/-
Lucas J.	£1	40/-	+1/3d	9½	10†	—	40/-	25/3
Marryat & Scott	2/-	7/9		22½	25	6 9 0	7/9	5/11
Mather & Platt	£1	47/6	+1/-	12½	15	—	47/6	32/-
Metal Industries	£1	34/9	−1/6d	12	9	5 3 6	42/3	29/6
Midland Elec. Mfg.	£1	67/6		15	15	4 9 0	67/6	63/-
Morphy-Richards	4/-	24/6	+9d	40	40	—	25/-	11/4
Muree	£1	50/6	−4/6d	15	15	5 18 9	57/-	50/-
Newman Ind.	2/-	2/4½		10	10	8 8 5	2/6	2/-
Oldham & Son	1/-	3/3		17½	17½	5 7 8	3/4	2/5
Parnall (Yate)	5/-	10/6	−6d	6	8	3 16 3	11/-	4/3
Parsons, C. A.	£1	57/6	−2/6d	12½*	7½*	2 12 3	60/-	38/1
Plessey	10/-	58/9		25	30	—	58/9	37/10
Pye Deferred	5/-	31/9	+3d	20	20*	3 3 0	32/6	15/7
Revo	10/-	14/-		27½	9*	6 8 6	20/3	14/-
Reyrolle	£1	87/6	−5/-	12½	13¾	3 0 3	92/6	66/-
Rheostatic	4/-	15/9xd	—	19	20	5 1 7	15/9	11/-
Richardsons Westgarth	5/-	11/9		15	15*	6 7 8	12/3	6/6
Scottish Cables	4/-	21/9	+9d	20	27½	5 1 3	21/3	12/11
Siemens Ord.	£1	39/-		10	10	5 2 6	43/9	33/9
Smith (England), S.	4/-	13/9	−3d	12½	15	—	13/6	7/8
Southern Areas	£1	25/-	−1/3d	6	7½	6 0 0	27/6	17/6
Strand Elec.	5/-	9/3		17½	17½	9 9 3	9/3	8/3
Sturtevant	5/-	45/-	+1/-	18·1†	18·9*†	2 2 0†	44/-	29/-
Sun Elec.	£1	32/6		15	15	9 4 8	32/6	27/6
Switchgear & Cowans	5/-	12/9		22½	10	3 18 6	13/7	9/9
Taylor Tunnicliff	5/-	11/-		25	12½*	5 13 9	12/4	10/7
T.C.C.	10/-	36/3		20	30*	—	36/3	21/3
T.C. & M.	£1	33/6		10	8½*	5 1 6	34/6	30/3
Telephone Mfg.	5/-	9/6		10	10	5 5 3	9/6	7/6
Thorn Elec.	5/-	26/6		12½	20	3 15 6	27/-	13/3
Thornycroft	£1	47/-	+3/-	15	15	6 7 8	47/6	33/4
Tube Investments...	£1	75/-	+3/9	15*	15	4 0 0	75/-	60/3
Vactric	5/-	17/-		Nil	10	2 18 9	18/9	7/6
Veritys	5/-	8/9	+1/3d	10	12½	7 2 9	8/3	5/-
Walsall Conduits	4/-	51/3		70	70	5 9 4	52/6	44/-
Ward & Goldstone	5/-	39/6	+9d	45	50	—	39/6	21/-
Watford	2/-	7/-	+3d	25	22½*	—	6/9	4/7
Westinghouse Brake	£1	77/-	+3/3	14	15	3 18 0	77/-	60/9
West, Allen	5/-	16/6		15	17½	5 6 1	16/6	12/7
Wolf Electric	5/-	16 3	+1/6d	15	17½	5 7 9	14/9	11/-
Trusts, Transport and Communications								
Anglo-Am. Tel.:								
A Ord.	100	83½		—	6	7 3 9	89½	80
Ord.	100	54½		—	3½	6 17 6	55½	52
Anglo-Portuguese	£1	23/9	−6d	8	8	6 14 9	24/3	21/-
Brit. Elec. Traction:								
Def. Ord.	5/-	62/6	+1/3d	35	50	4 0 0	63/9	39/1
Cable & Wireless:								
Ord.	£1	42/6xd	+1/6d	8	9	4 4 9	49/6	26/2
4% Loan	100	98½		4	4½	4 1 3	98½	95½
Calcutta Trams	£1	23/-	−6d	2½†	6†	5 10 4	24/6	17/1
Cape Elec. Trams	£1	16/6xd		5½	7½	9 1 10	17/6	12/4
Marconi Marine	£1	34/6	−1/3d	10	10	6 3 0	33/9	27/6
Oriental Tel. Ord.	£1	90/-	−2/6d	16	16	—	95/-	82/6
Telephone Props.	£1	5½		8	8	—	5½	4½
Telephone Rentals	5/-	10/-	−3d	10	10*	—	10/6	9/-

Power-Samas

Interest in the 10s shares of Power-Samas Accounting Machines (in which Vickers have a controlling interest) has grown this year in correspondence with evidence of continuing expansion in the company's business. Latest signs of this were in the announcement that because of a large increase in the sale of products at home and abroad, arrangements were being made for additional capacity to be made available to the company by Vickers-Armstrongs. A few months ago, Vickers took up the second of a series of four issues of Loan Stock, each of half a million, intended to finance additional retail business, capital expenditure and stocks. From 35s earlier this year, the price of the shares has risen to about 49s. At this level, the yield on the basis of the 22½ per cent rate of dividend paid recently is not much over 4½ per cent.

"Capitalization" Issues

Officially, the Stock Exchange has now ceased to use the word "bonus" in connection with shares issued free to the shareholders of a company as the result of a capitalization of reserves. These are known now as capitalization issues, and the quotation of the shares in the official lists appears in due course as "x.c.", instead of the long familiar "x.b." The change has presumably the intention of helping to correct the impression that these operations convey to shareholders anything in the way of a gift.

"Teleprops" Scheme

General approval seems to have been secured by the Telephone Properties Co.'s scheme offering alternative courses of action to stockholders. Provision is being made whereby stockholders can either retain their investment as it is, or exchange up to three-quarters of their holdings for shares in a Realization Company to be formed for the purpose. Details of the proposals were much as had been expected and the shares concerned, which fluctuated hectically at times last year between extremes of 33s and 126s, show little further change at £5⅛ x.d. The meeting to consider the resolutions will be held on the 21st of this month, and if these are passed the forms, offering the alternatives to shareholders, will be posted a few days later.

REPORTS and DIVIDENDS

George Cohen, Sons & Co., Ltd.—The accounts for the year to 31st March last show consolidated trading profits of £1,190,951, as compared with £1,740,392 for 1952–53, and the net profit of the parent company, after deducting £873,954 for taxation, is £169,839 (against £198,508) which with £79,030 brought in, makes £248,869 available. The ordinary dividend for the year is maintained at 12 per cent by a final payment of 8½ per cent and £80,124 is carried forward.

In his circulated statement, Mr. C. M. Cohen (chairman and managing director) says that last year he predicted a return to less abnormal times and said that they expected both a substantial fall in turnover for the year under review and a drop in profits. At about £18 million, turnover was some £3½ million less, while profits, after charging depreciation, were down by £550,000. Even so, the result was creditable showing a return of 23 per cent on capital employed. Mr. Cohen reviews the activities of the various companies within the group.

Strand Electric Holdings, Ltd.—A group profit of £50,740 is reported for the year to 30th April last, as compared with £39,228 for the preceding year, and the net balance, after deducting taxation, is £23,972 (against £20,938). The dividend for the year is maintained at 17½ per cent.

Stream-Line Filters, Ltd., reports a trading profit for 1953 of £292,187, as compared with £179,571 for the previous year, and a net balance of £93,775 (against £55,497). Against this is charged an interim dividend of 5 per cent paid in November last and a further interim of 15 per cent paid in June. It is proposed to pay a bonus of 20 per cent and to place £5,000 to fixed assets replacement reserve, leaving £167,303 (£100,528) to be carried forward.

International Combustion (Holdings), Ltd., has declared an interim dividend on the ordinary stock of 10 per cent (against 5 per cent).

Associated Electrical Industries, Ltd., is paying an interim dividend of 4 per cent on the ordinary stock on capital increased by a 100 per cent scrip issue. Last year's interim dividend on the smaller capital was 7½ per cent.

The Palestine Electric Corporation, Ltd.—In view of the terms of the offers of the Israel Government to purchase the ordinary stock and shares and "A" ordinary stock of the company contained in their letter dated 22nd August, the directors regret that they are not in a position to recommend the payment of a dividend for the year ended 31st December last on the ordinary stock and shares and "A" ordinary stock. The net profit for the year, after all charges including IL 600,000 for taxation, is IL 562,323. Net profit for the previous year, after providing for all charges, was IL 36,344.

A. H. Hunt (Capacitors), Ltd., has declared an interim dividend of 7½ per cent (unchanged).

The British Thermostat Co., Ltd., is paying an interim dividend of 7½ per cent (unchanged) on capital increased by a 50 per cent scrip issue.

A. Reyrolle & Co., Ltd., have announced an interim dividend of 6¼ per cent (unchanged) on increased capital.

The British Oxygen Co., Ltd., is paying an interim dividend of 6 per cent (same).

New Companies

I. G. Bailey & Co., Ltd.—Registered 27th August. Capital £2,000. Radio, television and electrical engineers, electrical contractors and repairers and industrial electronic engineers, etc. Directors: I. G. Bailey and Phyllis M. Bailey. Regd. office: 51, Bearton Green, Hitchin, Herts.

K. Blair, Ltd.—Registered 27th August. Capital £2,000. Manufacturers and repairers of electrical, gas, oil lamps, quartz lamps, reflectors, bells, switchboards, dynamos, motors, armatures and generally electrical and gas plant, radio and television appliances, etc. Directors: K. I. W. Blair, Mrs. Edna D. Blair and F. R. Garrod. Solicitors: Carpenters, 26, The Broadway, N.W.7.

Minchom Magnetic Systems, Ltd.—Registered 26th August. Capital £100. Electrical and mechanical engineers, manufacturers of and dealers in electrical and other apparatus, etc. Directors: R. I. Minchom and Jenny L. Minchom. Solicitors: Nicholson Graham & Jones, 19–21, Moorgate, E.C.2.

Kimor, Ltd.—Registered 28th August. Capital £2,000. Merchants of and dealers in wholesale electrical goods and apparatus, cooking, heating and lighting appliances, etc. Directors: T. R. G. Moore and J. A. I. Knight. Regd. office: Barons Quay, Northwich, Ches.

Nicholls Bros., Ltd.—Registered 28th August. Capital £10,000. Radio, television, electrical and general engineers, etc. Directors: P. J. Nicholls and F. S. Nicholls. Regd. office: 74, High Street, Braintree, Essex.

G. H. Northover, Ltd.—Registered 4th September. Capital £3,000. To acquire the business of radio, television, electrical and refrigeration engineer now carried on by G. H. Northover at 28, Watergate Street, Chester. Directors: G. H. Northover and J. Benton. Regd. office: 28, Watergate Street, Chester.

Carlton Electrical Co., Ltd.—Registered 6th September. Capital £5,000. Electrical engineers, nuclear fission engineers, etc. Directors: R. Addy and G. L. Simmons. Regd. office: Sandal, Wakefield, Yorks.

Betavue, Ltd.—Registered 4th September. Capital £100. Manufacturers of and dealers in radio and television aerials, etc. Directors: S. A. Salter and C. J. Salter. Regd. office: 512/4, Brixton Road, S.W.9.

Lea Valley Finance, Ltd.—Registered 4th September. Capital £100. Hirers, hire purchase traders and dealers in radio and television sets, etc. Directors: G. Spriggs and Mrs. Stella M. Spriggs. Regd. office: 39, Queen Anne's Place, Bush Hill Park, Enfield, Mdx.

D. O. H. Coles, Ltd.—Registered 5th July. Capital £4,000. Manufacturers of and dealers in radio and television sets and electrical goods of all kinds, etc. Directors: D. O. H. Coles and Mrs. Gladys M. Coles. Regd. office: 13, Courtenay Street, Newton Abbot.

Faulkners Electrical Supplies, Ltd.—Registered 10th July. Capital £100. Solicitors: March, Pearson & Green, 1, Central Street, Manchester.

W.B.M. Installations, Ltd.—Registered 14th August. Capital £500 Electricians, radio and electrical engineers, experts and contractors, etc. Directors: W. E. Major and A. Baker. Regd. office: 1b, Bensham Manor Road, Thornton Heath, Surrey.

M.C.B. Company (Manchester), Ltd.—Registered 19th August. Capital £2,500. Electrical engineers and manufacturers of electrical equipment and component parts, etc. Directors: H. W. Wolff and Mrs. Alma D. Wolff. Regd. office: 6, Melrose Avenue, Sale, Ches.

Increases of Capital

Every Ready Company (Great Britain), Ltd.—Increased by £1,500,000 in 5s ordinary shares, beyond the registered capital of £1,500,000.

Sangamo Weston, Ltd.—Increased by £157,500 in 10s ordinary shares, beyond the registered capital of £317,500.

Bankruptcies

J. F. Gannon, 11, Barclay Street, Leeds, electrical engineer.—Last day for receiving proofs for dividend, 23rd September. Trustee, Mr. R. B. Smith, York House, 3, Alfred Street, Leeds, 1.

A. C. Payne, residing at 40, Springfield Road, Wickersley, Rotherham, Yorks, steelworks electrician, formerly carrying on business at that address as electrical contractor.—Public examination 30th September at the County Court Hall, Bank Street, Sheffield.

E. S. Mellor, 15, Cole Street, Scunthorpe, Lincs.—Last day for receiving proofs for dividend 25th September. Trustee, Mr. H. S. Bloomer, 8, Flottergate, Great Grimsby, Official Receiver.

P. Thomas, 43, New Street, Ledbury, Herefordshire, lately carrying on business at 4, New Street, Ledbury, radio and electrical engineer.—Last day for receiving proofs for dividend 25th September. Trustee, Mr. R. K. Clark, Somerset House, 37, Temple Street, Birmingham, 2, Official Receiver.

TRADE MARKS

AEROFLEX. No. 725,289, Class 9. Electric fuses, fuse carriers, switches and switchgear, cut-outs, and parts included in Class 9 of all these goods. — Parmiter, Hope & Sugden, Ltd., Fluvent Electrical Works, Newton Avenue, Longsight, Manchester, 12.

ACROWMATIC. No. 730,567, Class 9. Scientific, nautical, surveying and electrical apparatus and instruments, all included in Class 9; radio apparatus and instruments; weighing, measuring, signalling, checking (supervision), life-saving and teaching apparatus and instruments; fire extinguishing apparatus; and parts included in Class 9 of all such goods.—Acrow (Engineers), Ltd., South Wharf, Paddington, London, W.2.

ROB ROY "HANDYMAID." No. 731,154, Class 9. Electric flat irons.—Philip Woolfson, Ltd., 33, Cadogan Street, Glasgow, C.2; also trading as Scottish Precision Engineering Co., 27, Cadogan Street, Glasgow, C.2.

PRESIDENT. No. 731,418, Class 9. Electric floor polishing machines for domestic use.—Bylock Electric, Ltd., 109, South Street, Enfield, Middlesex.

STROLLER. No. 731,742, Class 9. Radio receivers.—E. K. Cole, Ltd., Ekco Works, Priory Crescent, Southend-on-Sea, Essex.

KINGSWAY. No. 721,468, Class 11. Electric ceiling fans.—General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

BENTRIC. No. 730,806, Class 11. Electric lighting installations and parts and fittings included in Class 11 for such goods.—The Benjamin Electric, Ltd., Brantwood Works, Brantwood Road, Tottenham, London, N.17.

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"VIBROVERTOR"

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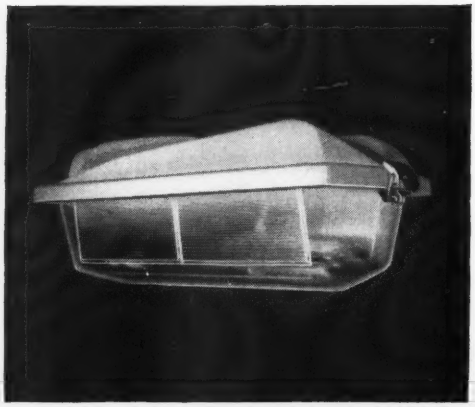

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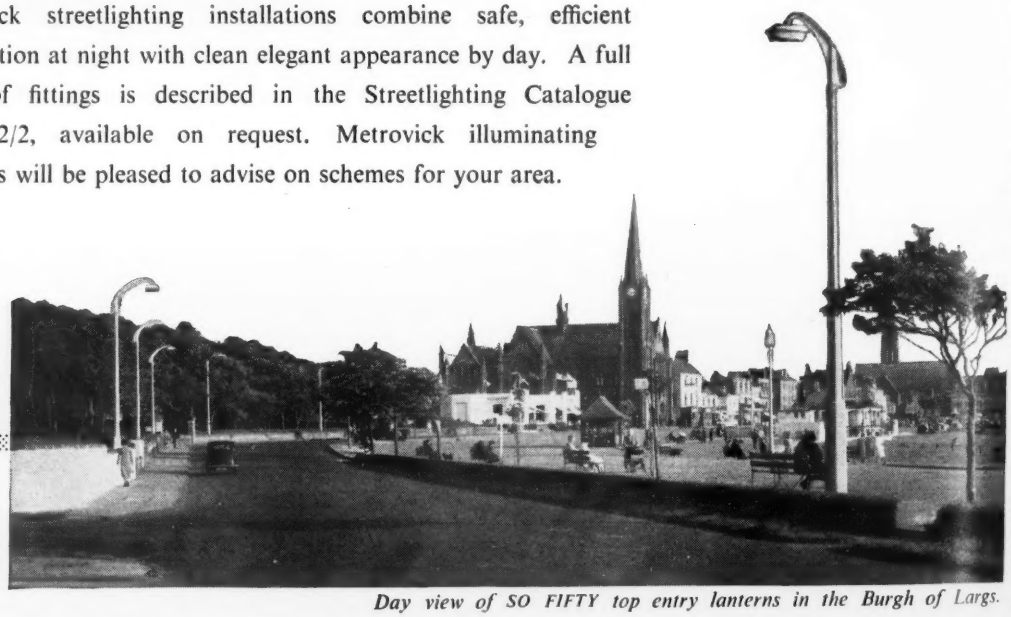
Metrovick streetlighting installations combine safe, efficient illumination at night with clean elegant appearance by day. A full range of fittings is described in the Streetlighting Catalogue SP 7152/2, available on request. Metrovick illuminating engineers will be pleased to advise on schemes for your area.



Day view of SO FIFTY top entry lanterns in the Burgh of Largs.

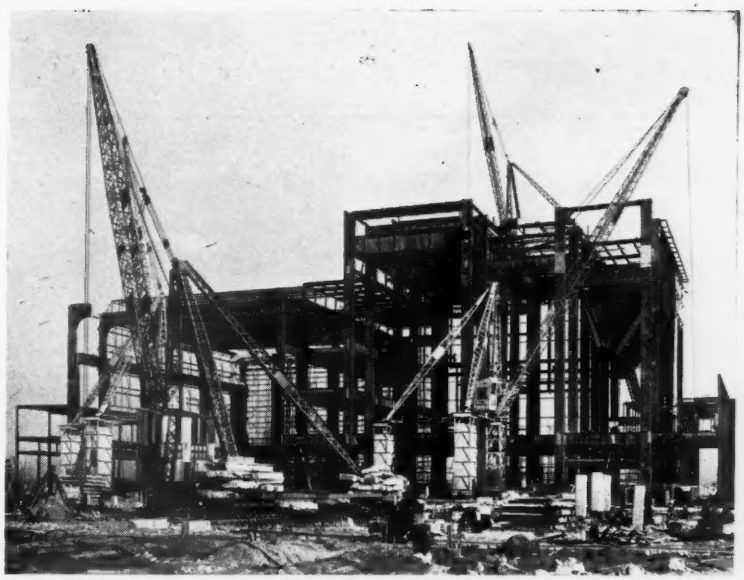
METROVICK street lighting

METROPOLITAN-VICKERS ELECTRICAL COMPANY LTD., St. Paul's Corner, St. Paul's Churchyard, London, E.C.4.

Member of the A.E.I. Group of Companies.

S/Q401

GENERATION AND DEVELOPMENT



Cross section of the steelwork for Marchwood generating station

Marchwood Generating Station

On Wednesday last week the foundation stone of the £30 million Marchwood generating station near Fawley, Hampshire, was laid by the Lord Lieutenant of Hampshire, the Duke of Wellington, K.G. This 180 MW station, which is planned to be partly in operation by the end of next year and finally completed during 1962, will be somewhat unconventional in appearance. Instead of a brick exterior the main buildings will have concrete block walls to a height of 30ft and above this the structural work will be of sheet aluminium and glass, with consequent reductions in building costs.

The site covers 144 acres of mudlands, saltings and rough pasture on the west bank of Southampton Water, with a river frontage of 3,200ft including 760ft of coal wharf. In view of this, extensive piling has been necessary. Already some 10,000 reinforced concrete piles have been driven, and the foundations use 128,000 cu yd of concrete in which 7,800 tons of steel reinforcement will be placed. The station will have two 425ft high concrete chimneys 23ft in diameter at the top.

Ultimately the station will have eight 550,000 lb/hr m.c.r. water-tube boilers, generating steam at 915 lb/sq in and 925 deg F at superheater outlet, designed for firing either with pulverized fuel or fuel oil or a mixture of both. On the generating side there will be eight 60 MW hydrogen-cooled three-cylinder impulse reaction 3,000 r.p.m. turbines with double flow l.p., the 11 kV alternator ratings being 60 MW at 0·8 power factor.

Exe Valley Reinforcement

During a visit last week to the Exe Valley District centred on Tiverton, Mr. S. F. Steward, C.B.E., chairman of the South Western Electricity Board, saw the results of major engineering works designed and carried out by the Board's staff to reinforce the supply network. He was accompanied by Mr. E. A. Newburn, manager of the Taunton Sub-Area, and Mr. H. T. Corrigan, Exe Valley District manager. In the past four years the demand for electricity in this almost wholly rural area has increased by over 40 per cent; 2,020 new consumers have been connected, including 225 farms and 1,625 houses and cottages. During the past year alone the demand for electric cookers has risen by 45 per cent and electric water heaters by 75 per cent. A 33 kV line has been extended from Tiverton Junction and a new substation has been built at Moorhayes.

Street Lighting

To preserve the attractive appearance of the ancient town centre of HADDINGTON, East Lothian, the south-east Scotland Electricity Board suggested that consideration should be given to the use of wall-mounted lanterns. Following a successful trial installation a scheme has now been completed utilizing twenty-eight Revo C. 31112 vertical wall-mounted fluorescent lanterns each housing three Philips Electrical 80 W "warm white" hot-cathode tubes controlled by instant start gear all of which is housed within the lanterns where space is also available for fuses and time-switches. As distinct from conventional street lighting where the practice is to brighten road surfaces in order that objects may be seen in silhouette, this method of lighting enables objects to be seen naturally by shape and colour rather than two-dimensionally. Consequently the perception of objects is improved. Besides freedom from colour distortion and absence of glare the system has the advantages of a comparatively low load of approximately 300 W for each lantern and lower maintenance costs. In Court Street where suitable buildings for wall mounting are not conveniently situated, Revo "Festival" lanterns mounted on cast-iron columns are to be used.

One of the latest street lighting schemes to be completed in SINGAPORE is in the Tiong Bahru area and Alexandra Road, where Mazda fluorescent lanterns, each having 2ft 40 W lamps, have been installed. Another recently completed installation is in Shenton Way, Singapore, which is lighted by "Mazda" 5ft three-lamp fluorescent lanterns. Altogether the British Thomson-Houston Co., Ltd., has supplied Malaya with £12,000 worth of street lighting equipment since the war.

Although COLERAINE, Londonderry, has its own Gas Department the Council has adopted a £30,000 scheme for re-lighting the whole of the town by electricity instead of by gas The gas manager said that the development of the present gas system to bring about the desired improvement would involve a capital expenditure of £20,000, with annual running costs of £9,500.

The GOSFORTH Urban District Council has applied for sanction to a loan of £1,200 for class "B" lighting on housing estates and new private roads.

The North Eastern Electricity Board is to carry out a street lighting improvement scheme at Shotton Colliery and Old Shotton at a cost of £6,399. SHOTTON Parish Council has approved the scheme.

A further eighty-two electric street lamps to replace gas lamps are to be installed by WIGSTON (Leics) U.D.C. at the estimated cost of £4,624.

Two unusual street lighting installations: vertical wall-mounted fluorescent lanterns at Haddington, Scotland (left), and twin-armed column used on a road island in Singapore

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 27th October from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1950

27470. Simplex Electric Co., Ltd.—Electric heating elements. 6th November, 1951. (717,494.)

1951

2480. General Electric Co, Ltd., and Robertshaw, R. G.—Electric discharge devices. 15th January, 1952. (717,231.)

3552. Standard Telephones & Cables, Ltd.—Railway signalling systems. 8th February, 1952. (717,495.)

5324. Commercial Radio-Sound Corporation.—Branch couplers for high-frequency wave transmission lines. 5th March, 1951. (717,497.)

7886. Muller, H.—Adjustable electric shell type inductive apparatus. 1st September, 1952. (717,498.)

10997. Midland Electric Manufacturing Co., Ltd.—Thermostats. 8th May, 1952. (717,317.)

12482. Turnock, Ltd., G.—Electric cable connector. 26th August, 1952. (717,319.)

12715. France, A.—Suction cleaners. 29th May, 1952. (717,578.)

17297. Siemens Bros. & Co., Ltd.—Electromagnetically - operated counting mechanisms. 17th July, 1952. (717,325.)

21794. British Thomson-Houston Co., Ltd.—Pull-in indicators for synchronous motors. 13th August, 1952. (717,586.)

21987. Marconi's Wireless Telegraph Co., Ltd.—Wide-band thermionic valve amplifier. 23rd May, 1952. (717,328.)

24466. General Electric Co., Ltd., Duckett, G. C., and Snow, S. F.—Electromagnetic switches. 15th October, 1952. (717,244.)

25375. Mayer, K. F.—Thermally-operated electric cut-outs. 26th September, 1952. Cognate application 13535, 28th May, 1952. (717,332.)

25720 and 27568. Sarazin, J. L., Sarazin, S. A., and Moneyron, M.—Electric arc welding of bolts, studs and the like. 2nd and 23rd November, 1951. (717,510 and 717,512.)

28121. Burger, E. A. K.—Electrical heat applicator device. 30th November, 1951. (717,336.)

29830. Jackson Electric Stove Co., Ltd.—Electric air heaters. 5th December, 1952. (717,431.)

1952

335. General Electric Co., Ltd., and Beesley, J. H.—Electric discharge tube circuits. 11th November, 1952. (717,597.)

439. Falk, Stadelmann & Co., Ltd.—Pull switch. 5th January, 1953. (717,598.)

1250. Automatic Manufacturing Corporation.—High frequency variable inductances. 16th January, 1952. (717,519.)

1379 and 4390. General Electric Co., Ltd., and Friedlander, E. S.—Electric motor control systems. 9th and 14th January, 1953. (717,253 and 717,606.)

3851. Ariel Pressings, Ltd.—Electric valve-holders or sockets. 11th February, 1953. (717,344.)

6393. C.A.V., Ltd.—Electric air heaters for diesel engines. 10th March, 1953. (717,612.)

6428. General Electric Co., Ltd., and Gledhill, G. A.—Sawtooth voltage pulse generators. 10th March, 1953. (717,262.)

6432. Godwillman, A. — Electrically driven remote position indication or control arrangements. 10th March, 1953. (717,346.)

7645. Radio - Industrie. — Television camera equipment. 25th March, 1952. (717,263.)

8237. Londex, Ltd., and Besson, A. P.—Electric winker devices incorporating electromagnetic interrupters. 24th March, 1953. (717,616.)

8289. General Electric Co., Ltd., Barry, J. N., Griffith, G. W. S., and Price, J. R.—Television apparatus. 20th March, 1953. (717,267.)

8499. General Electric Co., Ltd., and Polgreen, G. R.—Electromagnetic chokes. 3rd July, 1953. (717,535.)

8701. Soc. Elettrotecnica Chimica Italiana (S.E.C.I.), and Canegallo, G.—Resistor protected with resin insulating material and method of making same. 4th April, 1952. (717,354.)

8970. National Research Development Corporation.—Measurement of electrode current and pressure in electric spot welding. 8th April, 1953. (717,356.)

9278. Metropolitan-Vickers Electrical Co., Ltd.—Control of mine hoists and the like. 8th April, 1953. (717,539.)

11037. Electric Furnace Co., Ltd.—Induction heat treatment of workpieces having cylindrical surfaces. 1st May, 1953. (717,620.)

11303. General Electric Co., Ltd., Brandreth, R. D., and Garthwaite, F. N.—Electric switch assemblies. 5th May, 1953. (717,275.)

12315. Burgess Battery Co.—Primary batteries. 15th May, 1952. (717,543.)

12605. British Thomson-Houston Co., Ltd.—Electron emission coating mixtures. 19th May, 1952. (717,362.)

13827. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Methods of separating phosphate ions from iron ions. 30th May, 1952. (717,277.)

17080. Aktiebolaget Tudor. — Electric secondary cell and separator for same. 7th July, 1952. (717,373.)

17226. Metropolitan-Vickers Electrical Co., Ltd.—Control of electrically driven conveyors. 22nd May, 1953. (717,552.)

17727. Westinghouse Electric International Co.—Electrically insulating coatings for magnetic sheet material containing iron. 14th July, 1952. (717,627.)

18229. General Electric Co.—Cyclic overlap electric rectifier switching mechanism. 18th July, 1952. (717,376.)

18367. New Era Industries (Tottenham), Ltd., and Pickess, A. R.—Casings for electric conductors. 21st July, 1953. (717,629.)

18373. British Thomson-Houston Co., Ltd.—Electric incandescent lamps. 21st July, 1952. (717,630.)

19153. General Electric Co.—Magnetic cores. 29th July, 1952. (717,286.)

19401. General Electric Co.—Selective signal transmission systems. 31st July, 1952. (717,288.)

19644. Telefunken Ges. für Drahtlose Telegraphie.—Television receivers. 5th August, 1952. (717,380.)

20938. Siemens-Schuckertwerke Akt.-Ges.—Control means of electric motors for driving mine winding gear. 20th August, 1952. (717,384.)

22063. Filrex.—Electrical resistances. 2nd September, 1952. (717,390.)

22364. High Duty Alloys, Ltd.—Electrically conductive joints. 17th August, 1953. (717,640.)

23576. Philips Electrical Industries, Ltd.—Circuits for counting pulses by ignition of gaseous discharge paths. 19th September, 1952. (717,643.)

24470. Radio Corporation of America.—Automatic frequency or phase control systems for electric oscillation generators. 30th September, 1952. (717,396.)

25349. General Electric Co., Ltd.—Photo-electric machine guards. 28th September, 1953. Addition to 664,797. (717,399.)

28085. Ateliers de Constructions Electriques de Charleroi.—Means for counting documents. 7th November, 1952. (717,4[illegible])

28413. Bendix Aviation Corporation.—Self-contained power units having a turbine driven generator. 11th November, 1952. (717,647.)

29528. Compagnie Générale de Télégraphie sans Fil.—Directional radio systems. 21st November, 1952. (717,651.)

29656. Makepeace Co., D. E.—Methods of making electrical contacts. 24th November, 1952. (717,652.)

31117. Borg Corporation, W. N.—Electromagnetic relay. 8th December, 1952. (717,655.)

32304. Siemens & Halske Akt.-Ges.—Mechanisms for the remote control of start-stop apparatus by electric signals. 15th December, 1952. (717,657.)

32615. Philips Electrical Industries, Ltd.—Electrical machines comprising permanent magnets. 23rd December, 1952. (717,485.)

32824. Ferranti Meters, Ltd., D., and Wright, L. C.—Electricity meters. 27th November, 1953. (717,660.)

1953

11849. Commercial Radio-Sound Corporation.—Branch couplers for high-frequency wave transmission lines. 5th March, 1951. Divided out of 717,497. (717,565.)

1954

16376. Pierce Foundation, J. B.—Electrical connectors for making a tapping from a linear conductor. 20th April, 1951. Divided out of 716,315. (717,570.)

NEXT WEEK'S EVENTS

Monday, 20th September

LONDON.—Northampton Polytechnic, St. John Street, 6.15 p.m. Institute of Metal Finishing, London Branch. "Surface Finishes by Vacuum Evaporation," by Dr. F. C. Weil.

Monday, 20th September, to Friday, 24th September

LONDON.—Old and New Horticultural Halls, S.W.1. National Display Convention and Exhibition.

Tuesday, 21st September

COVENTRY.—Electricity Sports and Social Club, Merrick Lodge, St. Nicholas Street. Coventry Electric Club. "Electric Space Heating and Thermal Storage," by J. L. Rycroft.

Wednesday, 22nd September

GLASGOW.—39, Elmbank Crescent, 7.30 p.m. Institute of Marine Engineers, Scottish Section. "The Condensing Gas Turbine," by J. F. Field.

LONDON.—At the Institution of Electrical Engineers, Savoy Place, 11 a.m. Electrical Industries Benevolent Association. Annual general meeting.

Friday, 24th September, to Saturday, 2nd October

LONDON.—Earls Court. International Commercial Motor Transport Exhibition.

Trades Union Congress

Discussions at the Brighton Meeting

INDUSTRIAL efficiency, output and productivity and their effect on living standards constituted the theme of Mr. J. Tanner's presidential address to the 973 delegates of 184 trade unions, representing more than 8 million members, who assembled at the Dome, Brighton, last week for the T.U.C.'s annual conference.

Mr. Tanner contrasted the fall of nearly 4 per cent in the gross national production of the United States between the second quarter of 1953 and the first quarter of this year with the marked improvement in Great Britain. This country's 1953 figures, he said, were 6 per cent higher than in 1952, and even higher than in 1951, previously the peak year. The first half of 1954 showed a continuance of this rate of increase. But we were still a long way from earning the required annual surplus of £300–£350 million which the Chancellor of the Exchequer had estimated—under estimated in Mr. Tanner's opinion—as needed to meet debt repayments, the building up of reserves, and meeting overseas investment obligations. He stressed that higher productivity, like full employment, was a means to an end, not an end in itself. The aim of the trade unions in concerning themselves about increasing industrial efficiency was the material well-being of their members; higher wages—real wages—better working conditions, more leisure, and all the other amenities which made life worth living. Greater individual output did not mean working harder and longer, only working more efficiently and effectively. By using modern machinery, equipment and industrial horse-power they wanted to enable the work-people to use their skill and craftsmanship more fully, with less fatigue, in shorter working hours and in more remunerative work. Mr. Tanner welcomed the declaration of the Joint Committee on Human Relations in Industry that it believed that "a greater human satisfaction in work is both compatible with and essential to increased efficiency and productivity."

Importance of Industrial Research

Another aspect of the industrial situation which concerned trade unionists, Mr. Tanner continued, was the importance of industrial research in developing new products, materials and processes in order to maintain and improve Britain's position in world markets. Linked with this was the necessity of overcoming the shortage of scientists and technologists in industry and to remedy the serious deficiency in teaching and training facilities.

Congress rejected a motion which requested the General Council to investigate the possibility of securing an amendment to the Factories Act so that workers under the age of twenty-one should not be permitted to work on night-shift except in times of national emergency.

Speaking on the production section of the General Council's report, Mr. Crawford said that the Council was not satisfied with the rate of capital investment in the electricity supply industry. British industry, in general, he said, was behind other countries in the matter of capital development. Modern management techniques were just as important as industrial relations. On production and productivity, Mr. Crawford hoped that affiliated unions would get together at Transport House to consider the problems involved.

Mr. Arthur Horner (N.U.M.) spoke of the increased coal output which, he said, was now 40 million tons more than before the war, and most of it was going to industry and not to the domestic consumer. During the first 35 weeks of this year industry used 5 million tons of coal more than in the same period of last year. Manpower was working more regularly and output per man was higher than in any country in Europe, including Western Germany.

Thursday was a day of shocks for the General Council. Mr. J. Mortimer, Association of Engineering and Shipbuilding Draughtsmen, administered the first. He was introducing a motion on the employment of older men and women. The motion refused to accept the recommendation of the National Advisory Committee on the Employment of Older Men and Women "that every effort should be made to remove from the minds of both employers and employees the idea that at any particular age retirement should be either compulsory or expected." The motion was not against permitted work beyond the normal age of retirement, but it took the view "that citizens have a right to expect to retire not later than 65 years of age."

Miss A. Godwin, for the General Council, charged Mr. Mortimer with bringing a nineteenth-century mind to a twentieth-century problem. She argued that in this modern age workers were no longer worn out and incapable of useful work at 60 or 65 as they were a hundred years ago. On a show of hands, Mr. Jack Tanner declared the motion lost. A card vote, however, resulted in 5,156,000 votes for the resolution and 2,794,000 against.

Friday's session began with some leeway to make up but there were still two big issues—wages and nationalization—to be debated.

Motion on Nationalization

Mr. Frank Foulkes, president of the Electrical Trades Union, moved a composite motion on nationalization. It recorded Congress's "profound conviction that the extension of public ownership to decisive sections of the national economy is a vital prerequisite for the achievement of an ordered, efficient and progressive economy capable of maintaining and improving the living standards of the people. Accordingly, Congress affirms its support for the principle of the social ownership of the basic industries, which include certain sections of the chemical and engineering industries." The motion asserted "that the building and civil engineering industries, together with the building materials industry, have a bad record of restrictive practices." It therefore approved "the policy outlined in 'Challenge to Britain' for a National Building Corporation responsible for the development of contracts by direct labour."

Mr. Foulkes concentrated on the manufacture of heavy electrical plant in his plea for further nationalization. He said that, while there had been small increases in the price of electricity since the industry was nationalized, the cost of heavy electrical plant had increased by 100 per cent since 1947. Nor could the manufacturers meet the demands of the British Electricity Authority. None of the capital development programmes had been completed. He could not accept that the test of whether an industry should be nationalized was efficiency or inefficiency. The real test was whether the industry was vital to the national economy. The manufacture of electrical equipment, like coal, was vital.

Mr. G. W. Lowthian seconded the motion on behalf of the Amalgamated Union of Building Trade Workers, and it was carried on a show of hands.

An E.T.U. motion which declared "firm opposition to any form of wage restraint" and promised support for any efforts made to improve the wages and conditions of employment of the working people, was moved by Mr. W. C. Stevens, general secretary. Opposition came from the National Union of General and Municipal Workers and the National Union of Mineworkers. The former thought the words "any efforts" would give a blank cheque for any kind of action, and the latter argued that the motion would favour the strong unions at the expense of the smaller ones. On a card vote, the motion was lost by 4,564,000 votes to 3,002,000.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—BRISBANE.—26th November. Electricity Department. Fuse switchgear and fuses. (E.S.B. 22028/54. Ten/10683.)*

SYDNEY.—14th December. Snowy Mountains Hydro-Electric Authority. Seven single-phase transformers and ancillary materials. (E.S.B. 21417/54. Ten/10602.)*

Belfast.—27th September. Northern Housing Trust. Electrical installations in 72 houses at Ballynarhinch, Co. Down. Offices of the Trust, 12, Hope Street.

Brazil. — PORTO ALEGRE. — 11th October. State Electricity Commission. Underground cables. (E.S.B. 21431/54. Ten/10603.)*

Burma. — RANGOON. — 26th October. Electricity Supply Board, Union of Burma. 116 transformers for the rural electrification scheme. (E.S.B. 21862/54. Ten/10657.)*

Burnley.—4th October. Water Department. Pumping and electrical equipment for proposed booster station. Water engineer, Yorkshire Street.

Colne (Lancs).—30th September. Borough Council. Sodium discharge street lighting installation. Borough engineer, Town Hall.

Durham.—30th September. County Education Committee. Electrical equipment for Walworth Castle, residential school. L. W. Davis, deputy director of education, Shire Hall.

Frome.—25th September. U.D.C. Electrical installation at North Hill House. B. H. Parkes, surveyor, 22, Christchurch Street West.

Grantham.—12th October. Corporation. Street lighting equipment. (See this issue.)

Grimsby.—14th October. Town Council. Electrical installation at new police headquarters in Victoria Street. Borough engineer, Municipal Offices, Town Hall Square.

India.—NEW DELHI.—14th October. Director General of Supplies and Disposals. (E.S.B. 21440/54. Ten/10616.)* 26th November. Oil circuit breakers. (E.S.B. 21436/54. Ten/10611.)*

BOMBAY.—11th October. Bombay Port Trust. H.v. and l.v. cables and accessories. (E.S.B. 21952/54. Ten/10667.)*

Iraq.—MOSUL.—2nd October. Mosul Electricity and Water Board. 1,000 kW diesel engine driven generating set. (E.S.B. 21555/54. Ten/10634.)*

Irish Republic.—CORK.—24th September. County Council. Pumping equipment, complete with electric motors, switchgear, etc. (E.S.B. 21925/54. Ten/10662.)*

Manchester.—30th September. City Council. Supply of street lighting equipment for one year from 1st January, 1955. City surveyor, Room 329, Town Hall.

New Zealand.—AUCKLAND.—8th October. Electric Power Board. Cable and joint boxes. (E.S.B. 22057/54. Ten/10705.)*

WELLINGTON.—12th October. Post and Telegraph Department. 300 rectifier valves. (E.S.B. 21566/54. Ten/10615.)*

Norwich.—24th September. City Council. Switchgear, cables and accessories for sewage disposal works, Whittingham. City engineer, City Hall.

Pakistan. — LAHORE. — 20th September. Stores Purchase Officer. Two electric lifts. (E.S.B. 21692/54. Ten/10643.)*

KARACHI.—19th October. Department of Supply and Development. Isolators, circuit breakers and transformers. (E.S.B. 21717/54. Ten/10653.)*

South Africa.—CAPE TOWN.—18th October. Electricity Department. Varnished cambric insulated cables. (E.S.B. 22018/54. Ten/10694.)*

PRETORIA.—15th October. Union Tender & Supplies Board. Electric boiling pans, dishwashing machine, electric mixer, fish fryer and floor polishers. (E.S.B. 22064/54. Ten/10696.)*

Uruguay.—MONTEVIDEO.—14th October. Administracion General de las Usinas Electricas y los Telefonos del Estado. Submarine cable. (E.S.B. 21625/54. Ten/10637.)*

20th October. Armoured cables. (E.S.B. 21626/54. Ten/10636.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Belfast.—Harbour Commissioners. Street lighting equipment for Belfast Harbour (£3,903).—Metropolitan-Vickers Electrical Co.

Bridgwater.—Corporation. Fifty concrete lighting columns, lanterns, 140 W sodium lamps, control gear, etc. (£3,472).—G.E.C.

Gloucester. — City Council. Electrical installation at fire station, Eastern Avenue (£2,884).—W. T. Turner & Co.

Hastings.—Water and Fire Brigade Committee. Recommended. Four electrically driven pumps for the Rother pumping station (£3,435).—Worthington-Simpson. Switchgear for Rother station (£3,539).—Igranic.

Keswick.—U.D.C. Supply and erection of 37 concrete lighting columns fitted with fluorescent lanterns (£2,956).—Revo.

Lancashire.—Education Committee. Recommended. Re-wiring work at County Secondary School, Crosby (£1,913).—Broughton & Irlam Electrical Engineering Co. Installation work at Hornby Street County Secondary School, Heywood (£1,869).—North Western Electricity Board.

London.—BATTERSEA.—Borough Council. Electrical installations in 192 flats at Anerley Street housing scheme.—Alpha Manufacturing & Electrical Co.

Electrical installation work in a memorial wing of the Victory Ex-Service's Club, Edgware Road.—F. W. Wheeler & Co.

Newcastle-on-Tyne.—Regional Hospital Board. Electrical installation at new X-ray department, Dryburn Hospital (£1,892).—North of England Engineering & Electrical Co.

Nottingham.—Sheffield Regional Hospital Board. Recommended. Re-wiring of wards and provision of individual bed lights at Harlow Wood Orthopaedic Hospital (£1,130).—Farrow & Pickford.

Stockport.—Recommended. Electrical installations at St. Michael's (Nangreave Road) R.C. Secondary Modern School (£4,732) and installation works and the transfer of machinery at Hempshaw Lane annexe, Stockport College (£1,371).—Piggott & Whitfield. Electrical installations in 75 dwellings at the Brinnington Neighbourhood Unit (£2,335).—Jones, Morris & Co.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Blackpool.—Extensions to factory, Devonshire Road, for Symbol Biscuits, Ltd.; Grenfell Baines & Hargreaves, architects, 12, Guildhall Street, Preston, Lancs.

Cardiff.—Proposal for new offices at rear of Law Courts (£316,070); town clerk.

Crawley.—Out-patients', casualty and maternity units at General Hospital; South West Metropolitan Regional Hospital Board, 11, Portland Place, London, W.1.

Croydon.—Factory and offices; Louis Newmark, Ltd., watch manufacturers, Prefect Works, Stafford Road, Croydon.

Daventry. — Secondary Modern School (£141,000) for Northants E.C.; county architect, County Offices, Guildhall Road, Northampton.

Don Valley.—Primary schools at Barnburgh (£35,000) and Bawtry (£35,000); architect to Don Valley Divisional Education Executive, Doncaster.

Dudley.—Factory at Lower Gornal for Clifford Williams & Son, Ltd.; T. Humphrey & Sons, Ltd., Lombard Street, Birmingham.

Ealing.—Buildings for slipper baths and laundry at South Ealing; borough engineer, Town Hall, W.5.

Easton (Norwich).—Additions to School of Agriculture (£35,000); county architect, Thorpe Road, Norwich.

Farnworth. — Departmental stores at 157/161, Market Street; F. W. Woolworth & Co., Ltd., 1, New Bond Street, London, W.1.

Hartford (Cheshire).—First section of scheme for college of further education; J. G. Kellett, director of education, City Road, Chester.

Harwich.—School (£150,000); Johns & Slater, architects, 32, Foundation Street, Ipswich.

Horwich.—Buildings for headquarters and research department in Chorley New Road; J. W. Roberts, Ltd., asbestos manufacturers, Canal Road, Leeds, 12.

Huntingdon.—Dwellings on the American Lane site; borough architect.

Killingworth. — Grammar school (£135,000); A. Anderson, Ltd., Stanmore Road, Newcastle-on-Tyne.

London.—Development of site in the Fenchurch Street/Mark Lane/London Street area, for headquarters building; Institute of Marine Engineers, 85, Minories, E.C.3.

ISLINGTON.—Four-storey block of dwellings, Tollington Park; town clerk, Town Hall, Upper Street, N.1.

PADDINGTON.—Dwellings (45), St. Luke's Road and Westbourne Park; borough housing architect.

ST. PANCRAS.—Headquarters and offices, Euston Road; National Union of Mineworkers, 5, Westminster Bridge Road, S.E.1.

Manchester.—Office block at Colliery Street for J. Mountford & Co., Ltd.; Peter Hodgkinson, Ltd., Devonshire Street, Ardwick, Manchester.

Newcastle-on-Tyne.—Additions to works; Vickers-Armstrongs, Ltd.

Newcastle-under-Lyme. — New premises at Bradwell Estate for Swettenhams, Ltd.; Hollins, Jones & Oldacre, architects, Lloyds Bank Buildings.

Plymouth. — Showrooms and offices, Western Approach; Welsh Bros. (Plymouth), Ltd., 16, Portland Square.

Portsmouth.—Rebuilding war destroyed Guildhall; E. Berry Webber, architect, 39, Gordon Square, W.C.1.

Reading.—Blocks of flats, Kentwood Hill; Kentwood Constructions, Ltd., Kentwood House, Tilehurst.

Workshops, offices and stores, Star Road; L. W. Yates, 107a, Kidmore Road.

Rochdale. — Experimental building at Arrow Mill; Courtaulds, Ltd.

Solihull.—Scheme for civic centre on site near Church Hill; borough surveyor, 90, Station Road.

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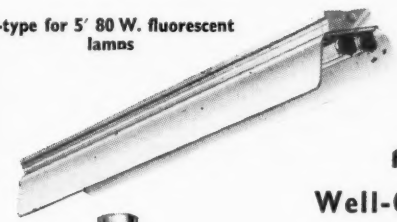
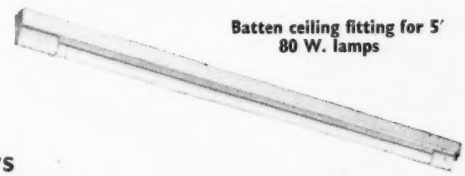


Batten ceiling fitting for 5′ 80 W. lamps



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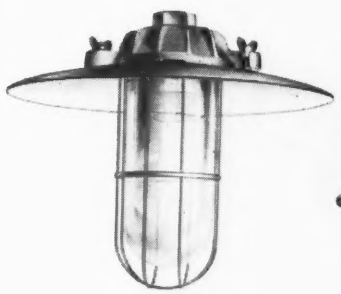

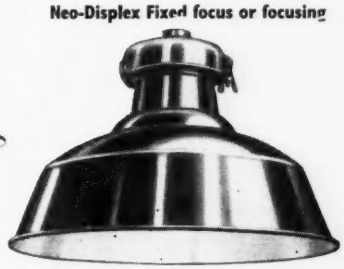

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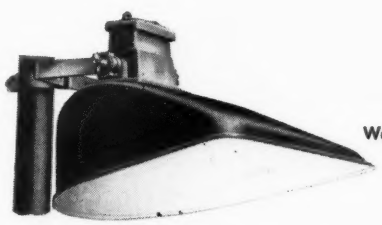

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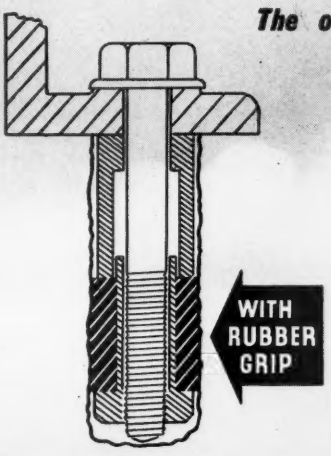

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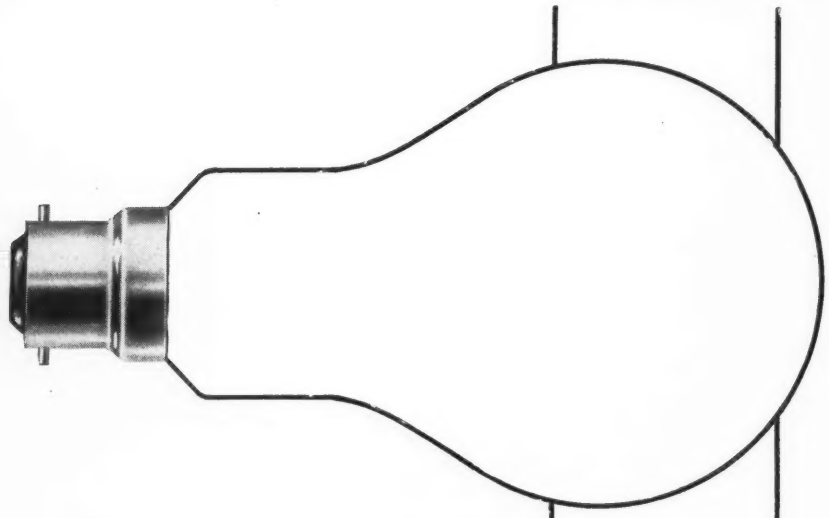

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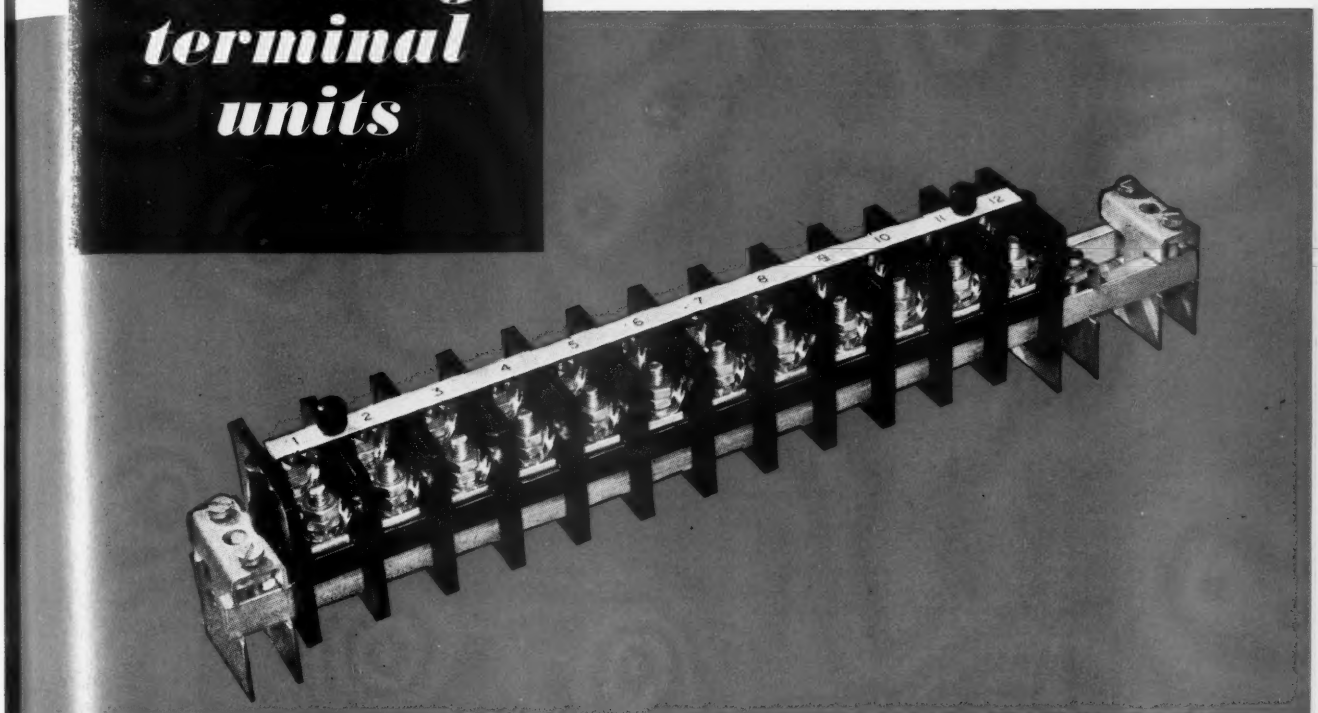

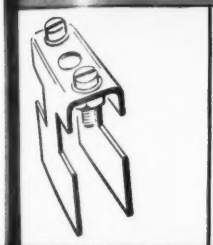

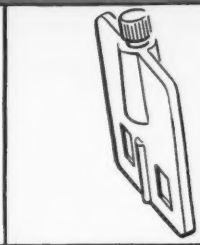

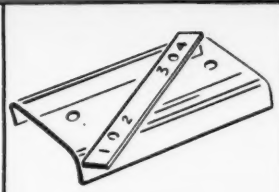

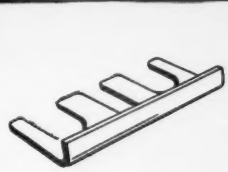

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DESIGN Any number of terminal ways, built from eight basic types of interlocking components. No live metal underneath, and room to pass cables under. Framework earths. Optional, bridging links, two, three or more ways. Supplied assembled and complete, or in parts to order.

MATERIALS Terminal pillars on solid plates, all nickelled brass, each pair on heavy moulded black phenolic segments, with separate barriers, all locking into position. Cadmium plated steel support bars, brackets and screws. Optional, nickelled copper bridging links.

DIMENSIONS Overall height $3\frac{3}{4}$", width 2". Length, two-way $5\frac{15}{32}$" increasing $\frac{29}{32}$" for each additional terminal way, example, twelve-way $14\frac{17}{32}$". Two $\frac{9}{32}$" fixing holes at centres $\frac{7}{8}$" less than overall length. Steel support bars $\frac{1}{2}$" x $\frac{3}{4}$".

TERMINALS Rating 60A. 660V. Each separate segment has two No. 0 B.A. Pillars, with lock nuts and claw terminals, or cable sockets if specified. Each interlocking segment can be separately removed, for easy connecting.

SHIELD & LABEL Optional. Both separately detachable, secured by insulated screwed knobs. Rigid transparent P.V.C. shield. Ivorine label supplied blank, or numbered lettered per terminal way to order.

INSTALLATION Units up to twenty-four ways, fixed with two No. 0 B.A. cadmium plated screws and nuts, supplied. Behind switchboards, on equipment panels, or mounted in Astral Adaptable or other boxes, cubicles, etc., as desired.

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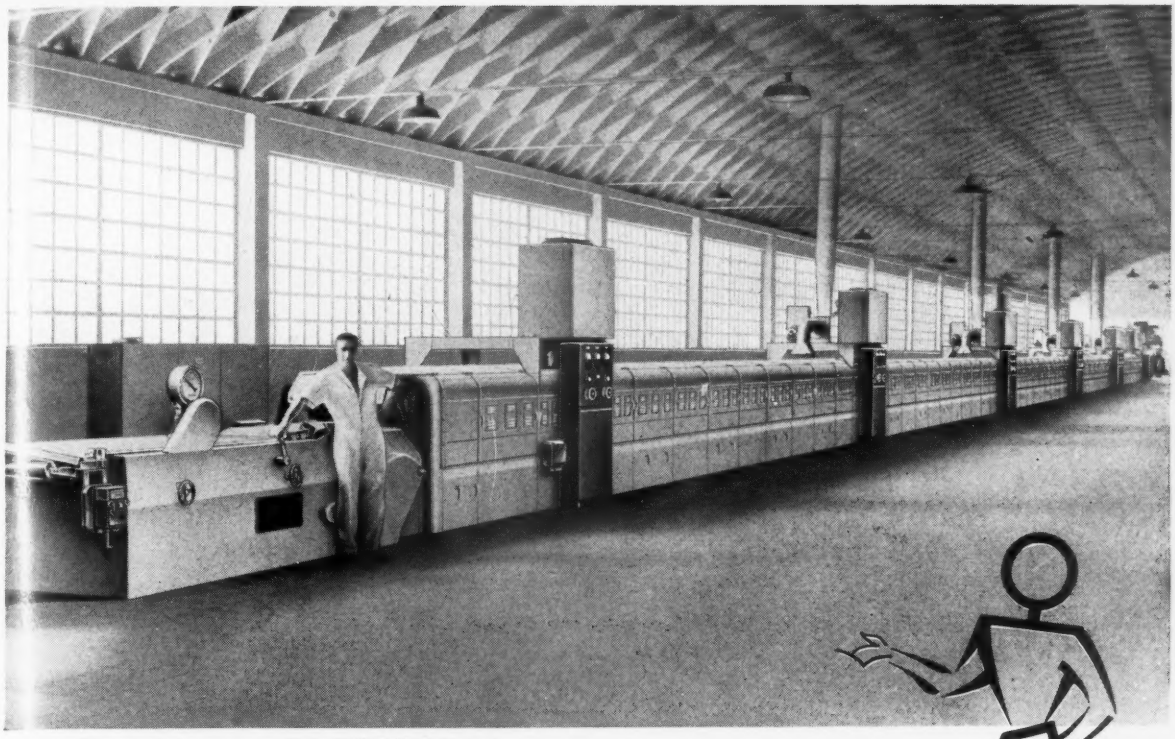

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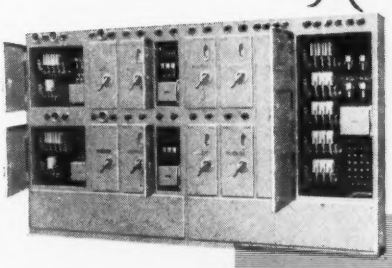

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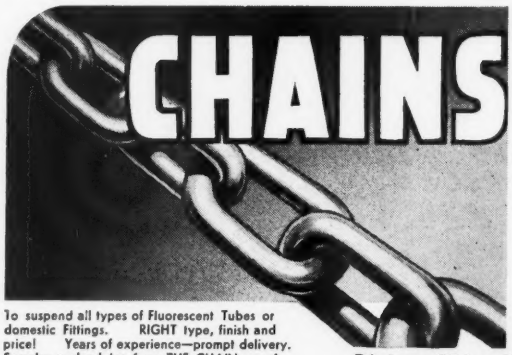

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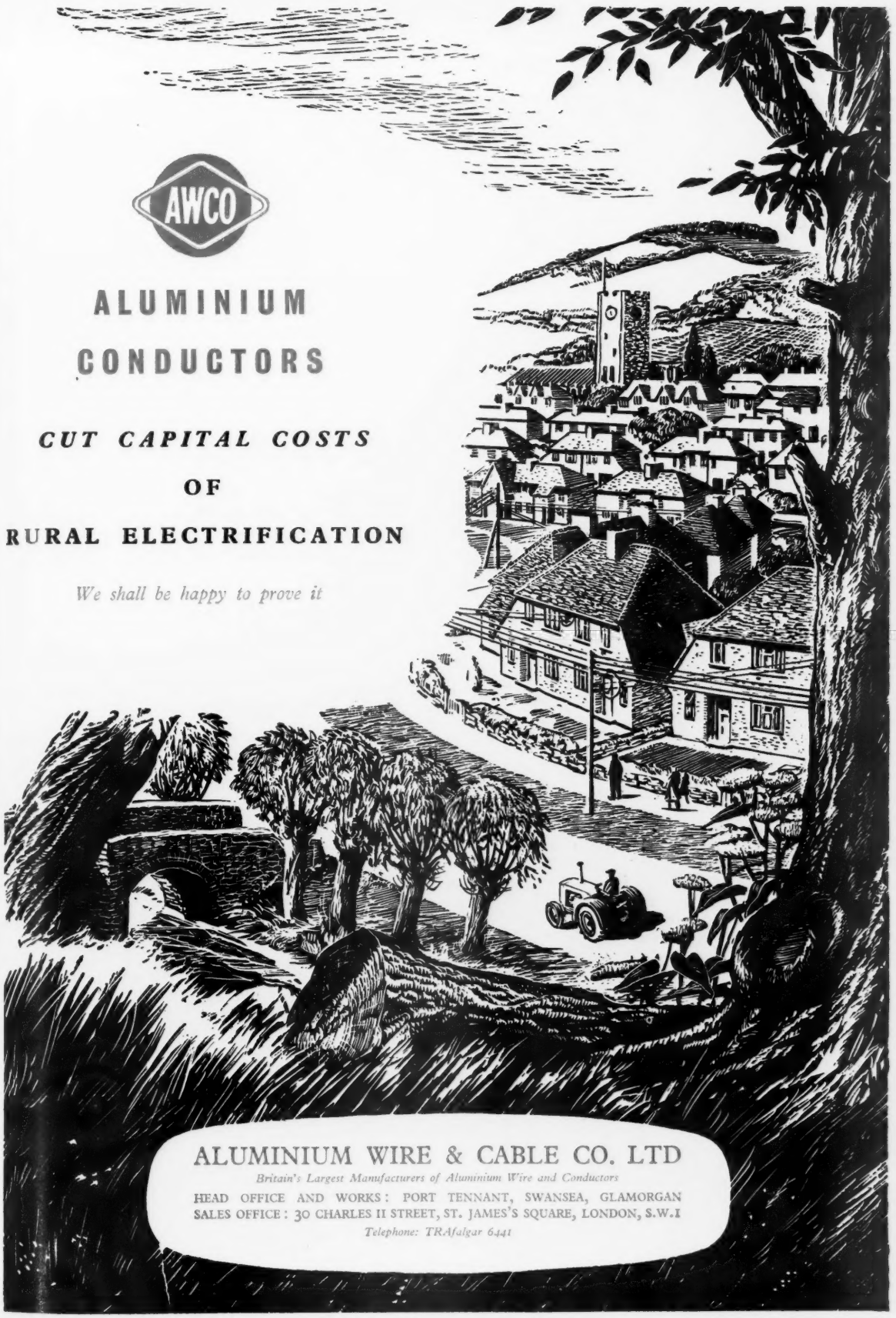

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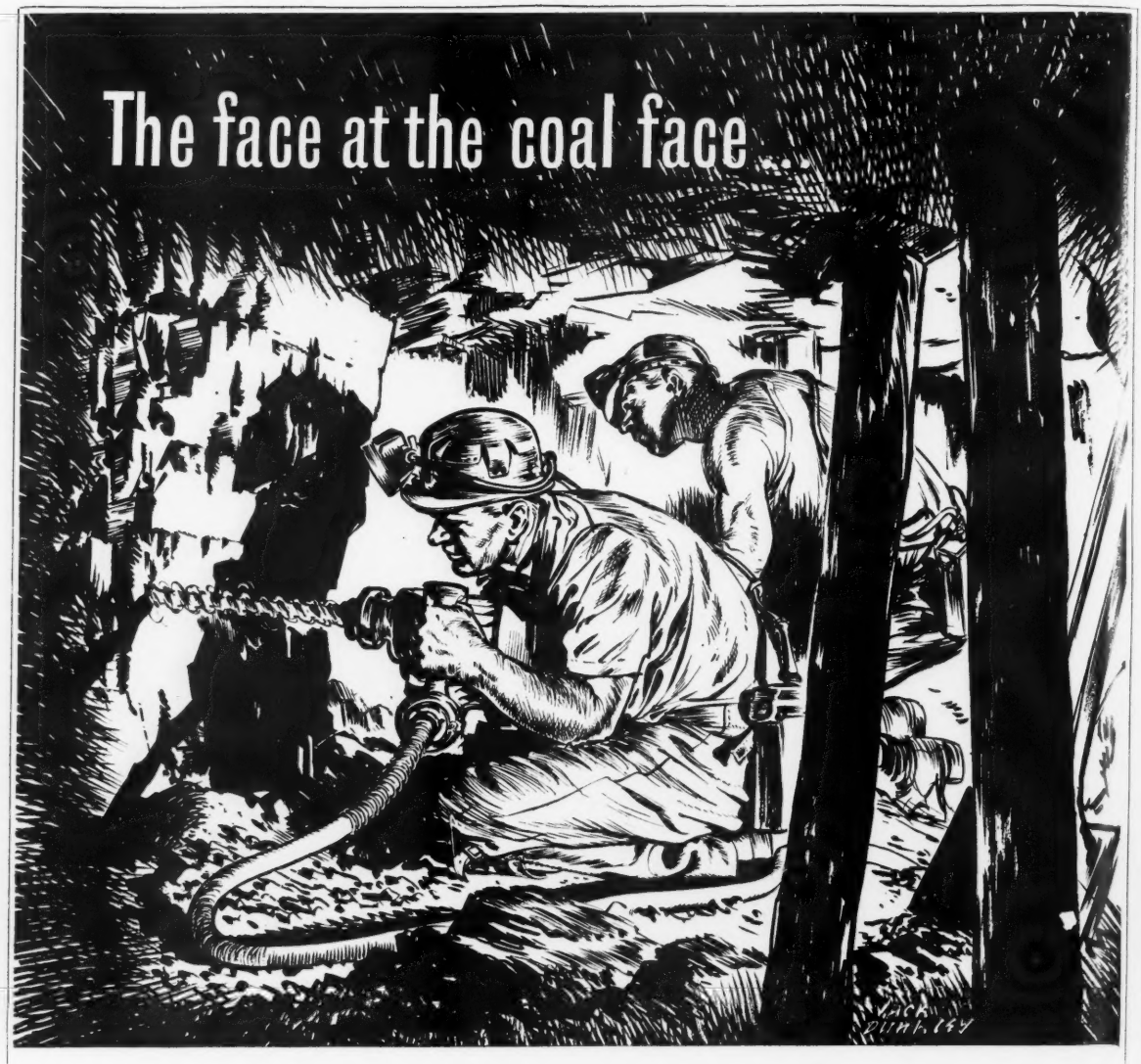

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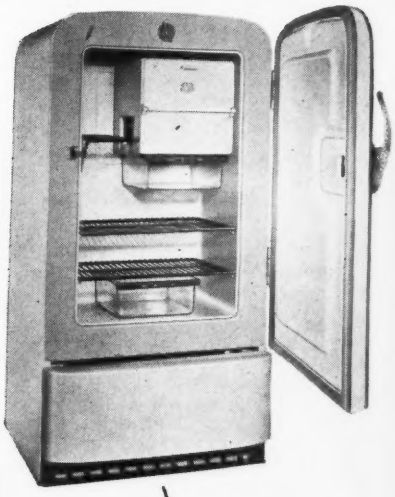

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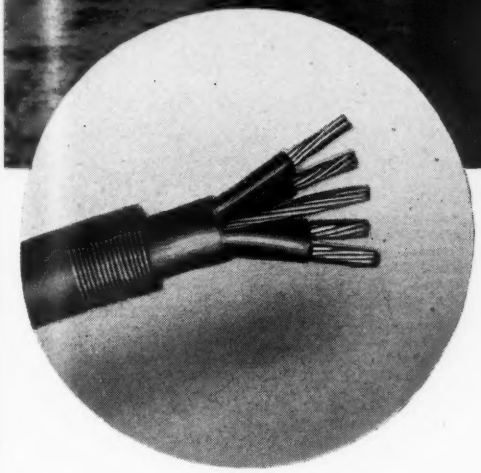

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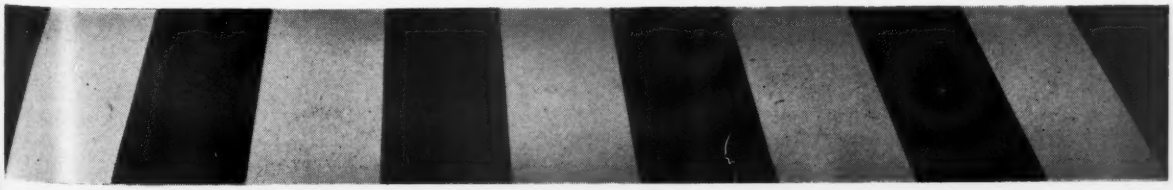

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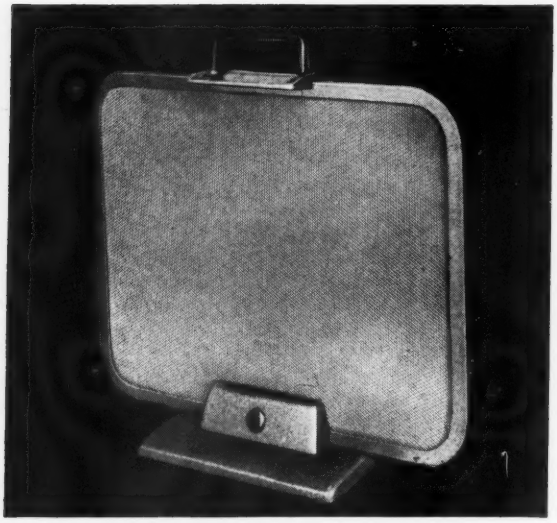
What is Expanded Metal?

Expanded metal is made from a solid sheet of rolled sheet metal—steel, stainless steel, aluminium, brass or copper. It is cut and expanded without any waste of material into a network of diamond shaped meshes. The finished meshwork is strong and durable; it is easy to work, weld and shape; it has a naturally decorative appearance and is suitable for most of the available finishing processes.

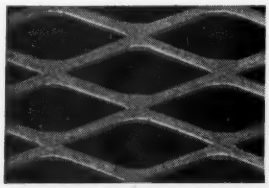
Two New Types

The two new basic ranges of expanded metal which are now on the market are Flattened and Safe-mesh "Expamet". The first, Flattened "Expamet", is made by brushing and pressure-rolling the strands and junctions of Expanded Metal, so as to obtain a flat, smooth and level surface. The other, Safe-mesh "Expamet", is a range of meshes which have been brushed to remove all burrs and rough edges.

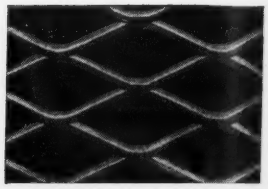


1 kw. Panel Heater *incorporating "Expamet" panels. Makers: Morphy Richards Ltd.*

Control Gear Guard *in Flattened "Expamet" for Ford Motor Company Ltd., Dagenham.*



Flattened "Expamet" *The above illustration shows an example of Flattened "Expamet". This is made in thirteen different weights and mesh sizes from 5/32" to 1¼" (shortway of mesh).*



Safe-Mesh "Expamet" *Pictured above is Safe-Mesh "Expamet" which is produced in eight standard weights, and in mesh sizes from ¼" to 1½" (shortway of mesh).*

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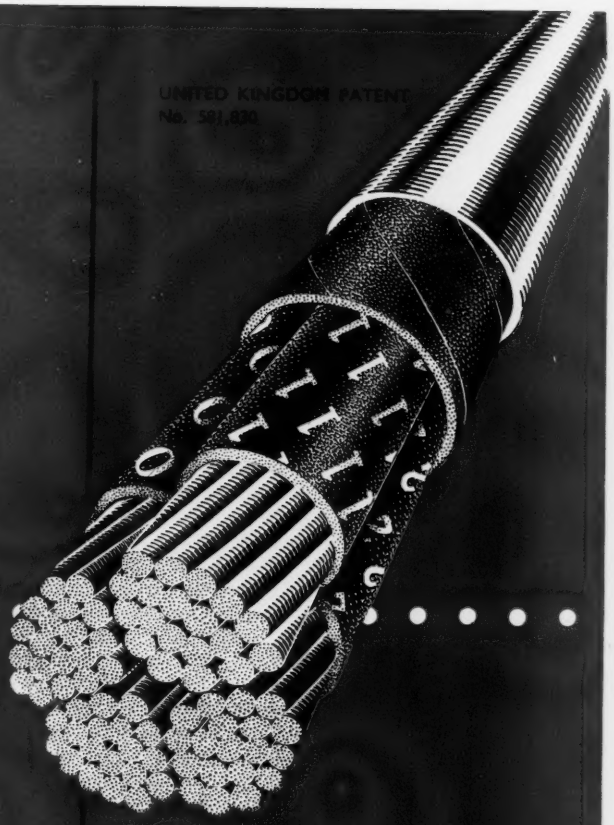

UNITED KINGDOM PATENT No. 581,830

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NOTE THESE IMPORTANT FEATURES

- The compound cannot migrate even on vertical runs at maximum permissible working temperatures.
- Designed primarily for use in buildings and mines — but equally suitable for installation in the ground.
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The mechanism, too, is simple, and no matter what happens to it the meter will register accurately.

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It is quite obvious to the meanest intelligence! If my deductions are correct we will discover our medium on such insulations as are enclosed in a metal circuit, eliminating discharges on the slot portion of motor coils and on instrument transformer coils. Yet this varnish medium is but one link in the case, for it holds a pure silk fabric coated with graphite—the whole being known to discerning electricians as Symoid Conducting Tape. Thanks to the valuable pioneer work of our old associate Inspector Symons, I am able to say that, as a flexible conducting material, Symoid can be used in all types of taping operations where a metallic tape would prove too rigid. An ingenious business, sir!

YMOID CONDUCTING TAPE

ure silk fabric coated with graphite held in a varnish edium. For all taping operations where metallic pe is too rigid. Resistance value varies linearly with ickness of coating, and will be lowered with age- g. Can be supplied in roll form 36″ wide and as pe either bias or straight cut.

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CONDUIT AND FITTINGS SUPPLIED BY

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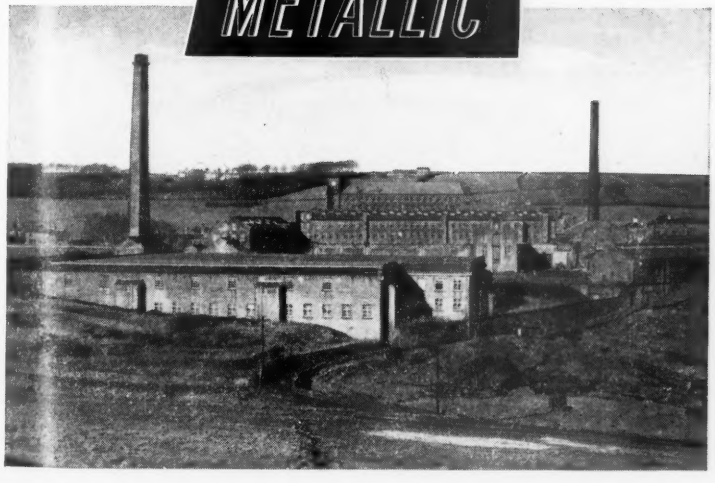

It may be a School, it may be a Factory — a Power Station or a Housing Estate, but more often than not the electrical specification will be — METALLIC.

This Yorkshire Mill is no exception, being fitted throughout with METALLIC Conduit and Fittings — unequalled for quality and consistent accuracy.

Denholme Mills, Nr. Keighley. Photo by courtesy of W. & H. Foster Ltd.

Electrical Contractors for this important installation: A. R. Farrar & Co. Ltd.

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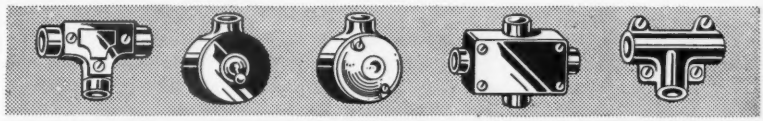

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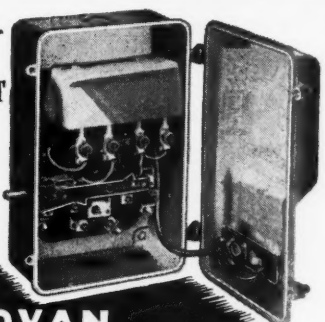

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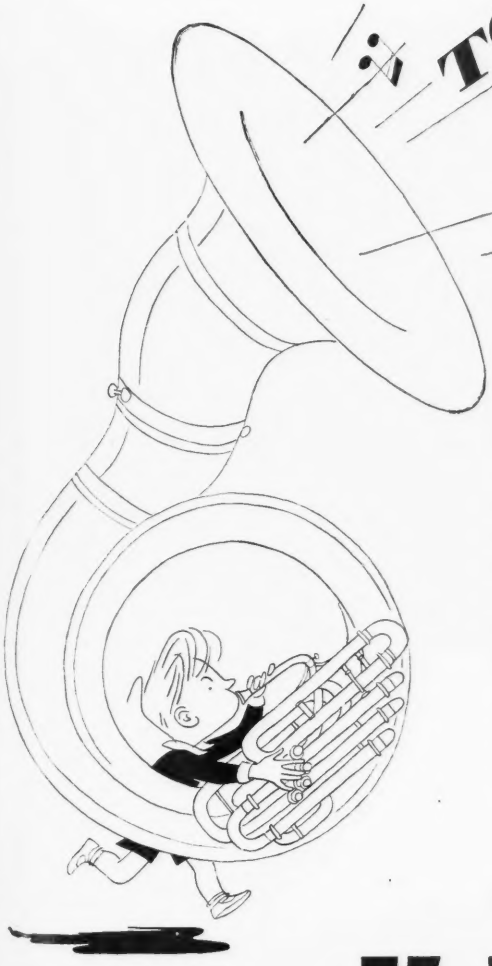

TOOT SWEET!

Remember the raucous 'Er-cha!' which cleared the way for Edwardian Genevieves? A far cry from the melodious 'Excuse me' of today. Manners, like horns, have improved since 1909. Yet even in those days Klaxon was cock of the walk — and sounded like it! For forty-five years the Klaxon has given voice to millions of vehicles, becoming ever more refined in tone, yet sticking leech-like to the dogged quality and robust construction which made its forebears famous and keeps them vocal still.

Today millions blow our trumpet for us the wide-world over. But don't let the dictionary fool you into thinking that Klaxon means motor horn and nothing else. Klaxon's reputation is rooted (we nearly said tooted) in skilled design and the use of good materials by faithful men. These same qualities are also to be found in a wide variety of electrically driven appliances which play a leading part in modern industry, as well as modern transport.

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with or without geared units.

KLAXON INDUSTRIAL SIGNALS
and power-driven Air Sirens.

KLAXON SYNCHRONOUS UNITS
in wide variety of gearings.

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(winkers) for motor vehicles.

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for screens of vessels and vehicles.

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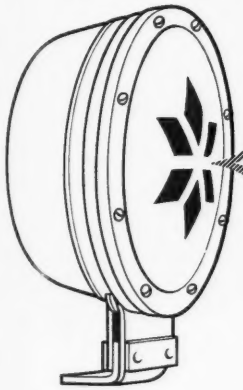

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TYPE H.F.8 FLAMEPROOF BUXTON CERTIFIED

The Klaxon H.F.8 Flameproof Signal has an audible range of 250 yards and can be supplied for voltages up to 250 for AC or DC supply.

This model is of the high frequency vibratory type and is manufactured to BSS.229 specification to conform with the Buxton Certificate provided. The movement can be fully tropicalised.

Klaxon Industrial Signals include a wide range of motor driven and vibratory types, having audible ranges from 100 yards to 1 mile. These signals are in extensive use in mines, oil refineries and industrial premises all over the world.

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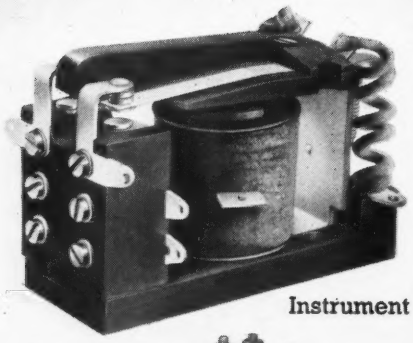
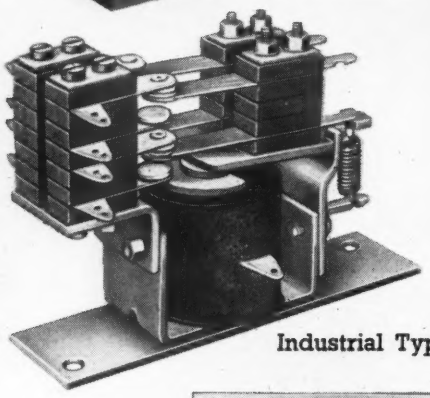
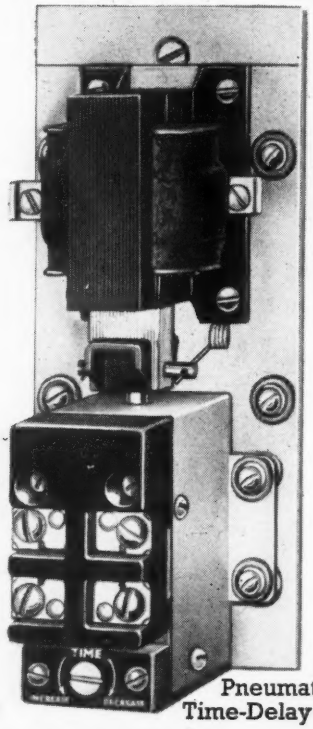


Instrument Type



Industrial Type

Miniature
Moving-Coil Type



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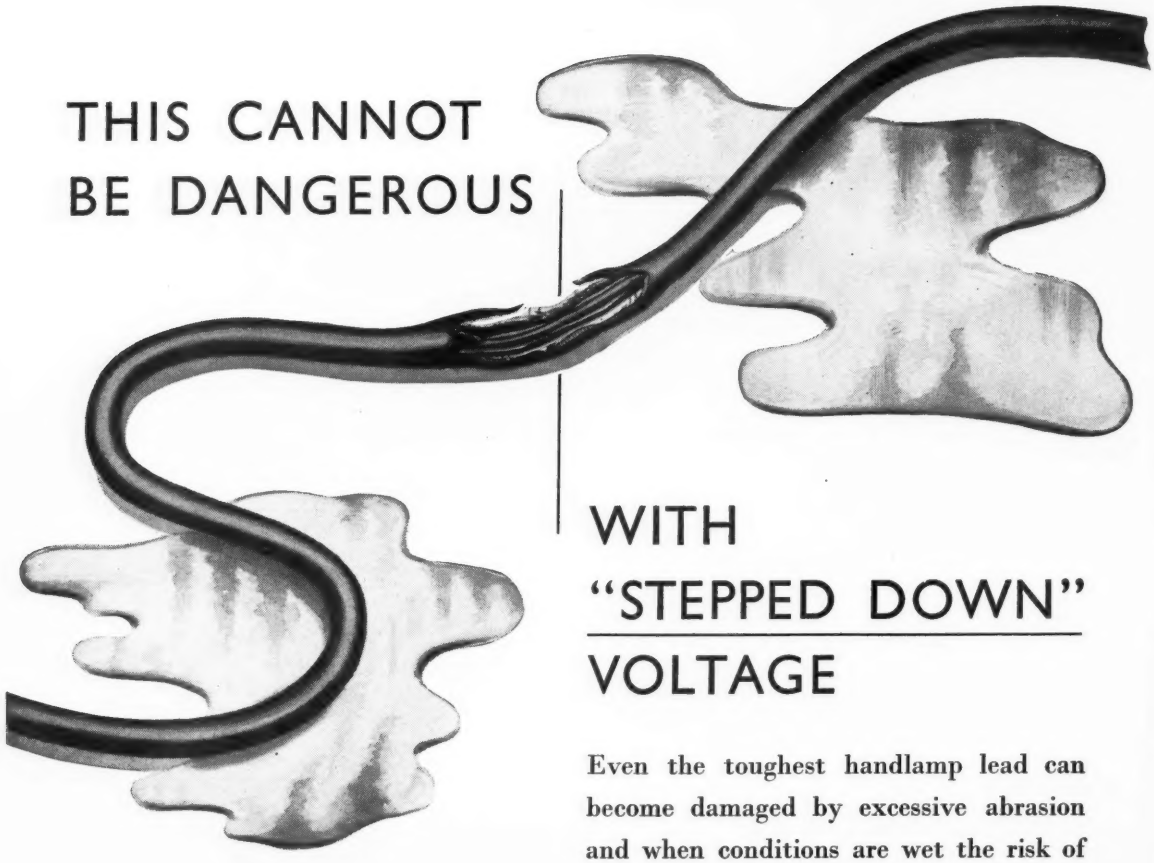

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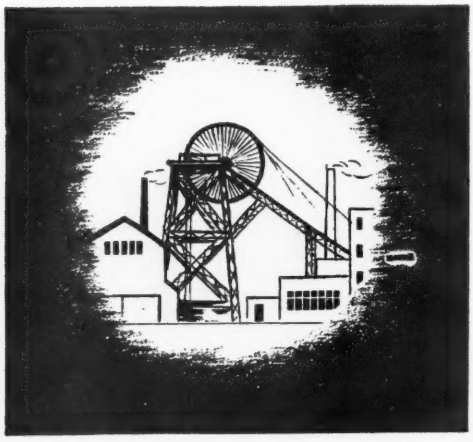
Even the toughest handlamp lead can become damaged by excessive abrasion and when conditions are wet the risk of fatal shock is, of course, far greater. For this reason you cannot afford to overlook the advantages of installing Igranic "Lo-Vo-Lite" low voltage lighting units. For full particulars ask for Publication 68000Z1, free on application to Publicity Dept., Bedford.



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Fluorescent lights are more easily serviced with L.E.F. RAISING & LOWERING GEAR

The obvious method of reaching inaccessible lights for servicing is to bring them down to where they can be dealt with at ease. Yet ladders and other improvisations are still employed.

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L.E.F. Gear is an economical proposition that deserves your careful consideration. *May we give you a demonstration at our works or send you full particulars?*

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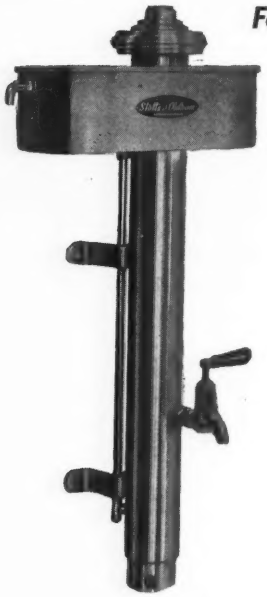
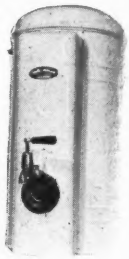
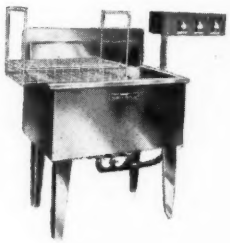


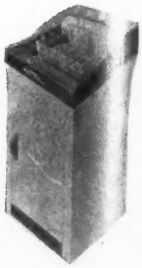
For Cafe Wall Boiler—with an output of 64 pints per hour. Loading 4 kWs.



Newport Water Boiler.
Large reserves and high outputs are the characteristics of this new "Stott" Electrically-heated Water Boiler which make it ideal for Industrial Canteens and large-scale Caterers.



Sterilising Sink.
After stripping and washing, crockery is immersed in the Sterilising Sink and then allowed to dry out by its own heat.



Electric Deep Fryer.
With quick reacting thermostat and high-efficiency elements, giving output of 27 lbs. of chips per hour. Swing-out elements for easy cleaning, and cool zone for sediment separation.

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Have you had your copy of "Tea Please"? Write for Brochure No. EA36

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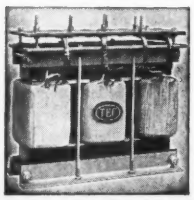

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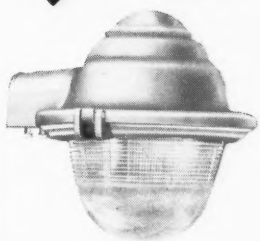
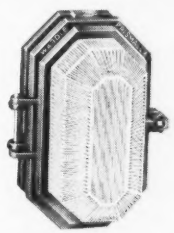
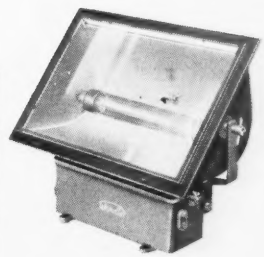


ASHLEY Lantern for G.L.S. or mercury discharge lamps. Three types of refractors available. Top or side entry. Interior finish white stove enamel, exterior aluminium. Positive weather sealing.

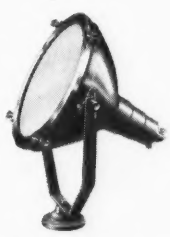


PRISMALUX Directional Lighting Unit, enamelled or galvanised finishes. Full sized reflector. Glass front includes carefully designed system of prisms to control the light.



Rectangular Floodlights for mercury discharge, and tubular line-filament lamps.

Dual-focus Floodlights of high efficiency for G.L.S. lamps, or projector lamps in cap up or cap down position. Swivel base-plates for mounting in position.



Circular Floodlights for G.L.S. or projector type lamps. Swivel base-plates for mounting in position.

WARDELYTE Conical Glassware fittings for schools, offices and similar situations. Suitable for B.E.S.A. box or conduit tube fittings. Shades are of finest polished opal glass, made in 4 sizes.

Reflectors for all industrial lighting, embodying the Wardle simple detachable top. Complete range of types for use with gas-filled or discharge lamps.

Wardle public, industrial and commercial lighting equipment is scientifically designed and made from high quality materials to give continuous efficiency in service. The designs illustrated are but a few of the complete range.

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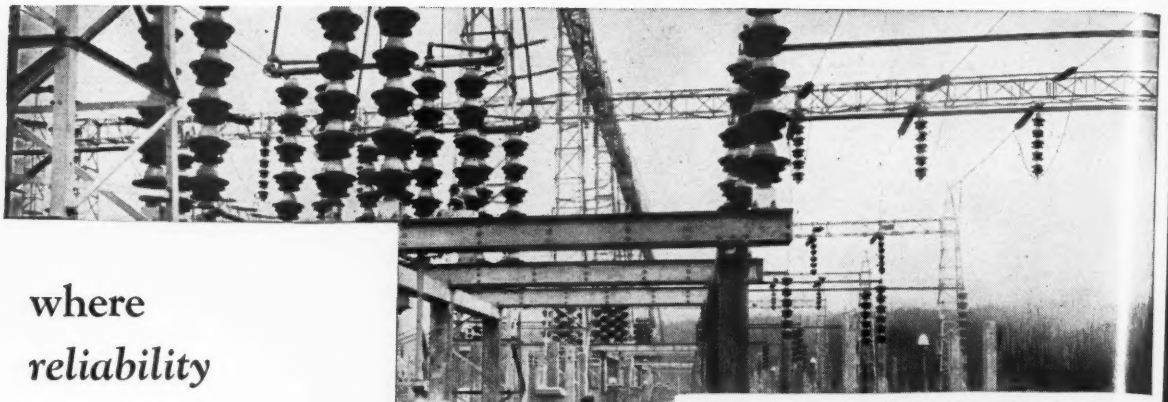

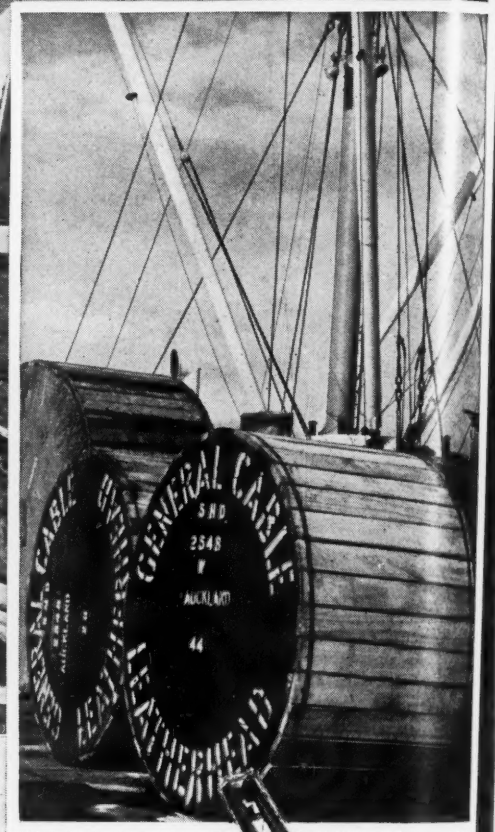

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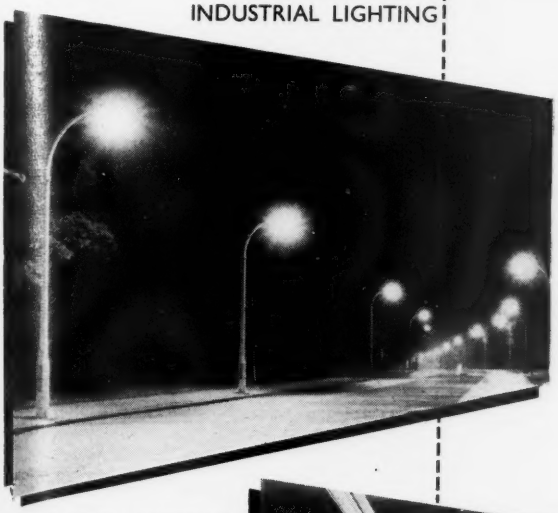

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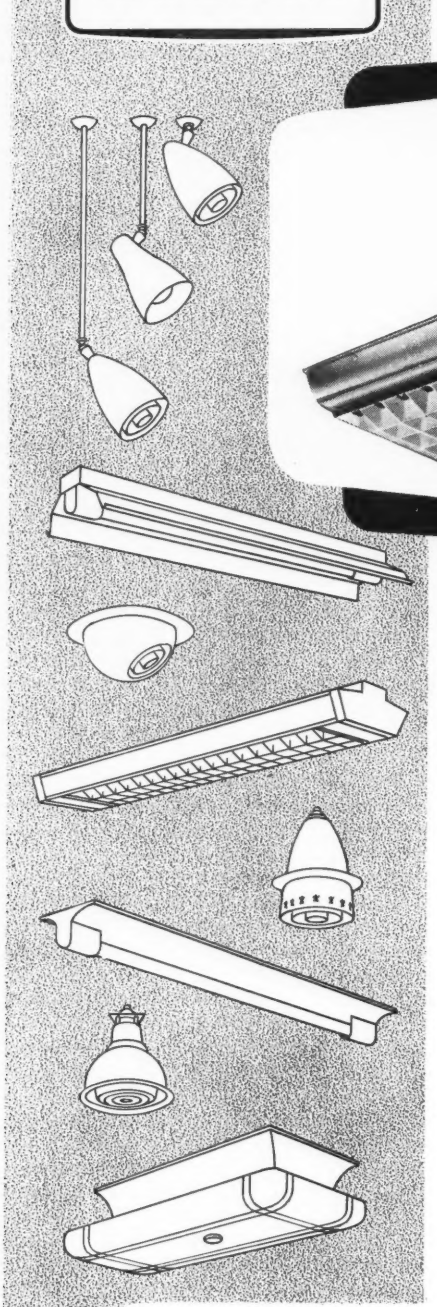
Fittings of Quality



THE MOSELEY

This attractive multi-lamp fluorescent luminaire has been specifically designed for the lighting of multiple stores, shops, public buildings, etc.

The metal surround is finished cellulose bronze or other approved colour and the white enamelled louvred base is detachable for cleaning. The whole body can be hinged down for access to lamps and control gear. Supplied complete with "Handslite" control gear wired ready for connection to mains supply.

Suitable either for direct mounting on ceiling or for suspension. Models are available for 4 or 3 lamps in both 5ft 80 watt and 4ft 40 watt sizes.

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Prices and further details on application.

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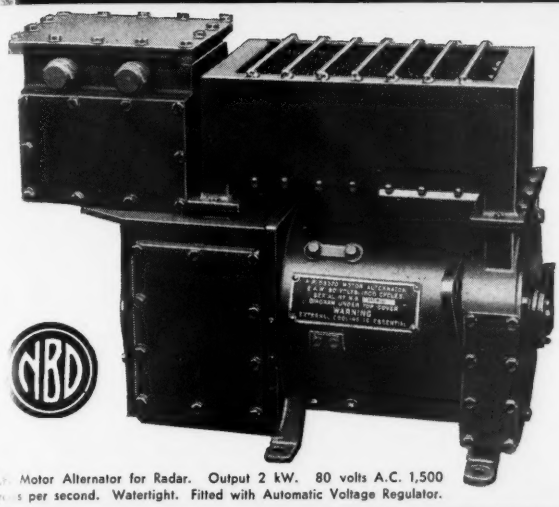

H.F. Motor Alternator for Radar. Output 2 kW. 80 volts A.C. 1,500 cycles per second. Watertight. Fitted with Automatic Voltage Regulator.

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(Send for publication No. 1003/2)

Also makers of Rotary Transformers and Anode Converters, Wind and Engine Driven Aircraft Generators, High Tension D.C. Generators, and Automatic Carbon Pile Voltage Regulators.

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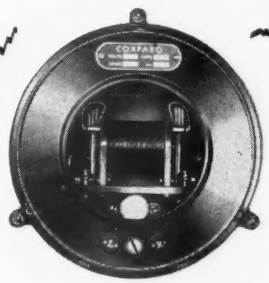
COXPARO *automatic* REGULATOR



This Automatic Voltage Regulator is only one of our standard range.

It has been in production for many years and has been gradually improved to its present high standard.

There are many hundreds in use and are being used by many alternator and generator builders.

As specialists in the field we shall be pleased to advise on the question of automatic voltage regulation if we may receive particulars of your specific requirements for any loading.

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- Suitable for A.C. and D.C. Machines.
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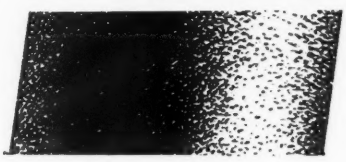
PROTECTION

The nature of Key Fibre Conduit construction provides unique properties in this field. Firstly, there is absolute and complete protection against electrolysis, acids, etc.; secondly, no material is used that could in any way corrode lead or other sheathing and thirdly, the material possesses fire resisting qualities—in the event of cable breakdown the conduit will not crack and fail under the heat conditions produced. Key Fibre Conduit is completely impervious to root action and is, in fact, toxic to these and fungoid types of growth—it does not crack or leak due to earth movement or vibration and is unaffected by sulphates and other chemicals found in soil. It ***always*** *remains watertight. The illustration below shows a piece of Fibre Conduit removed after more than 30 years underground —side by side with a piece taken from a current production run. Original photograph is available from our Head Office. The physical and chemical properties of Key Fibre Conduit make it perfect for its job.*

*Other Key points are: *Extreme lightness, effecting economy in storage, cost of transport, handling and laying. *Smooth interior surface, which cannot damage lead sheathed cable. *Simplicity in jointing. *Machined joints—perfectly aligned and absolutely watertight. *Fractional or nil breakage in transit. *Resilient to vibration.*

Prices have now been considerably reduced as a result of increased production by a recently opened factory in Southern England.

KEY FIBRE CONDUIT



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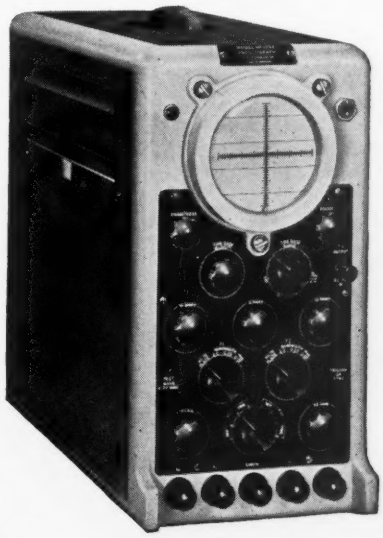
DHB

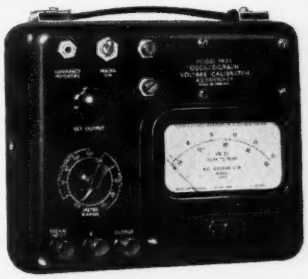
COSSOR presents Model 1052 double beam oscillograph



Two similar amplifier channels with an approximate gain of 2000 and an upper frequency response of 5 megacycles (— 6DB) are features of this new Cossor Double Beam general purpose oscillograph. The repetitive or triggered time base has a sweep duration from 200 milliseconds to 5 microseconds.

The instrument will operate from power supplies of any of the various frequencies and voltages encountered in the Armed Services or from standard civil supply mains.

and Model 1433 voltage calibrator



Primarily designed to be used with the Model 1052 oscillograph the Cossor Voltage Calibrator Model 1433 provides an accurate means of calibration of input voltages to the plates or amplifiers of any oscillograph. Calibrating voltages are read directly from a wide scale meter without any computation being necessary. Measurements can be made to an accuracy of ± 5% and the instrument can be used in any application where a source of accurately-known voltage is required.

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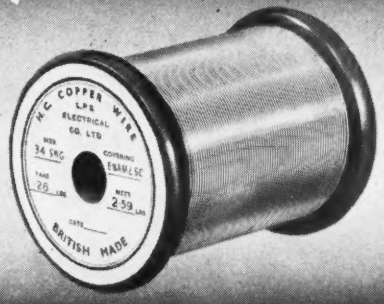

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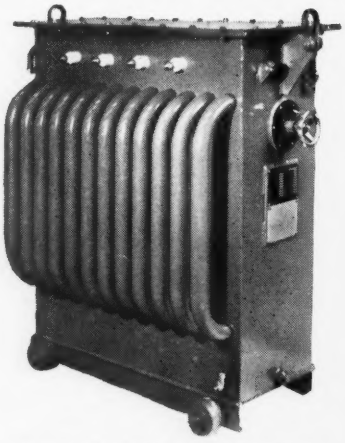

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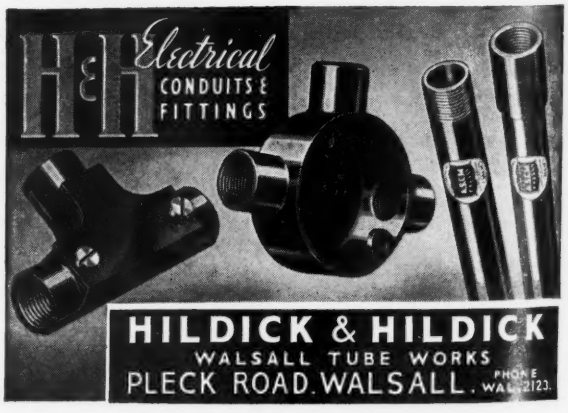

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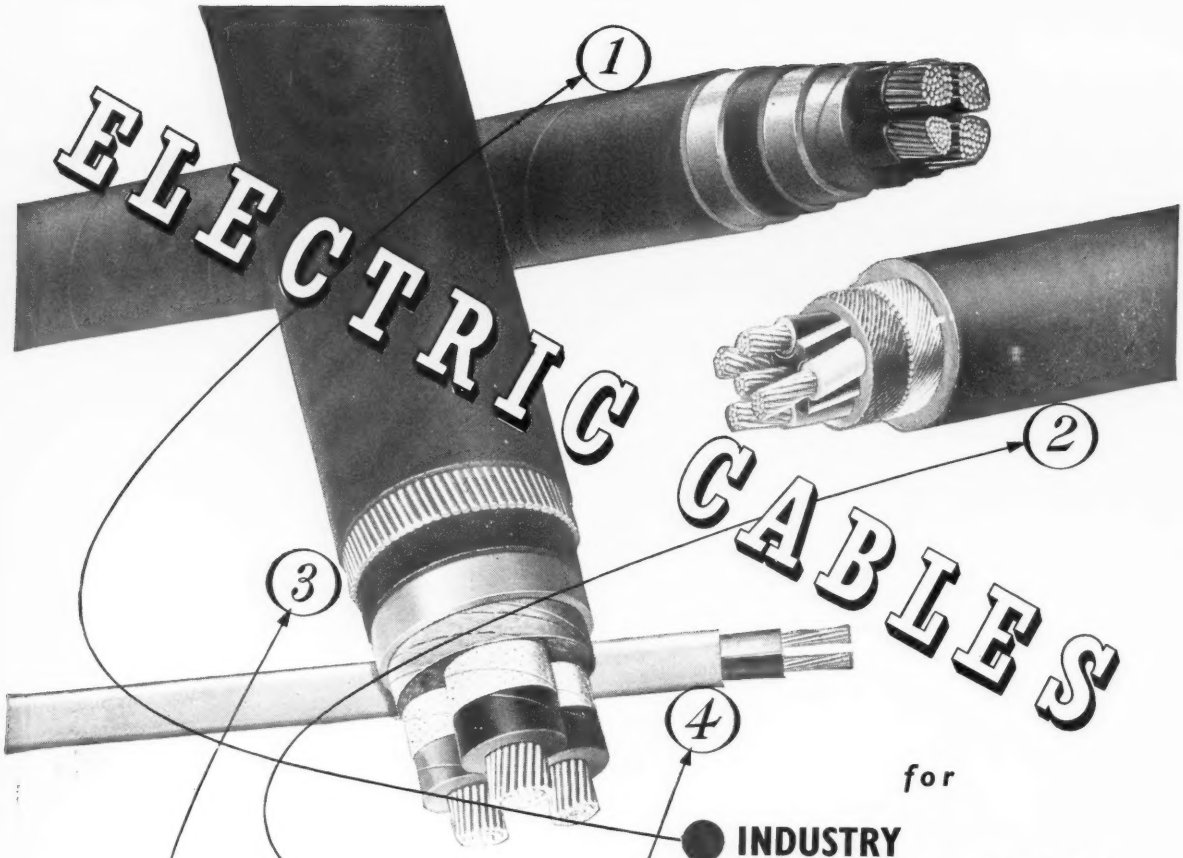

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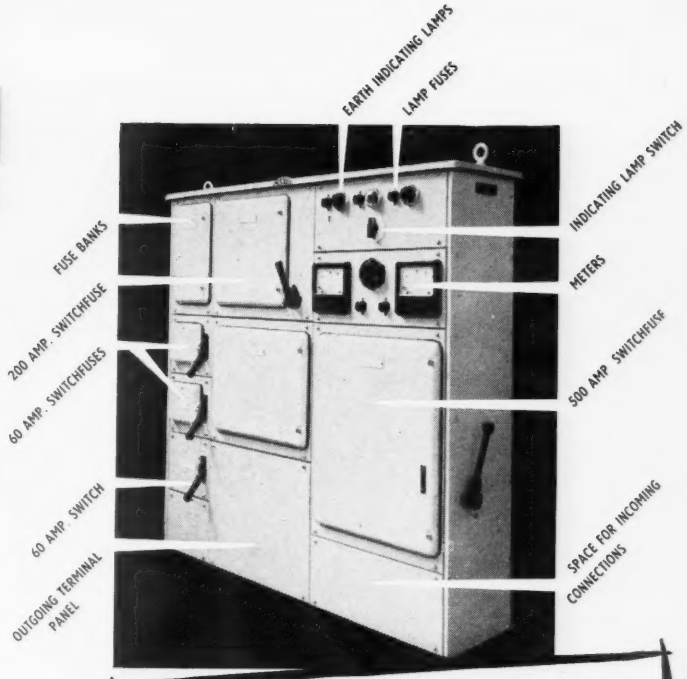

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WITH FINGER-TIP BEDSIDE CONTROL

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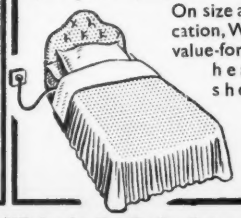

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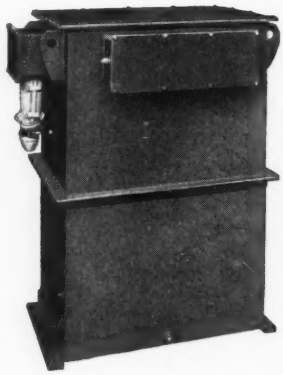

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Our technical service is at your disposal.

Illustrated Brochure describing our complete range is available on request.

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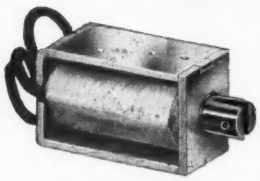

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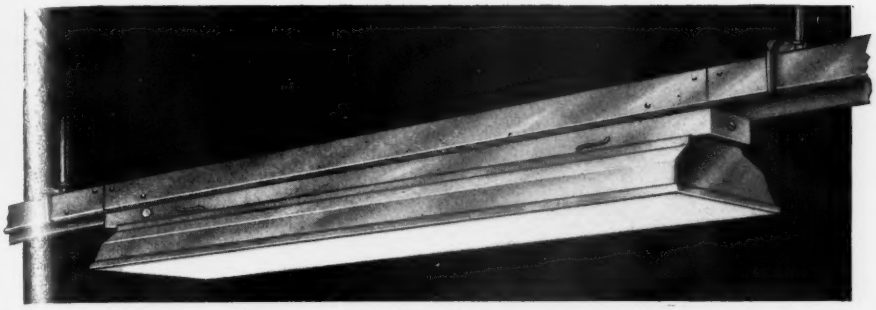
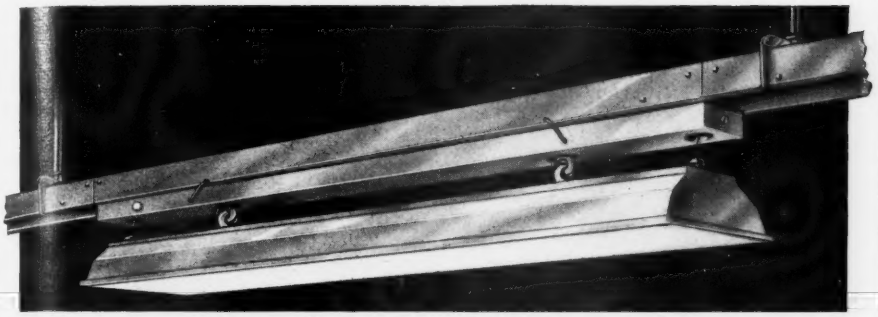
FLUORESCENT TROUGH
"SLYDA-LONG" SYSTEM

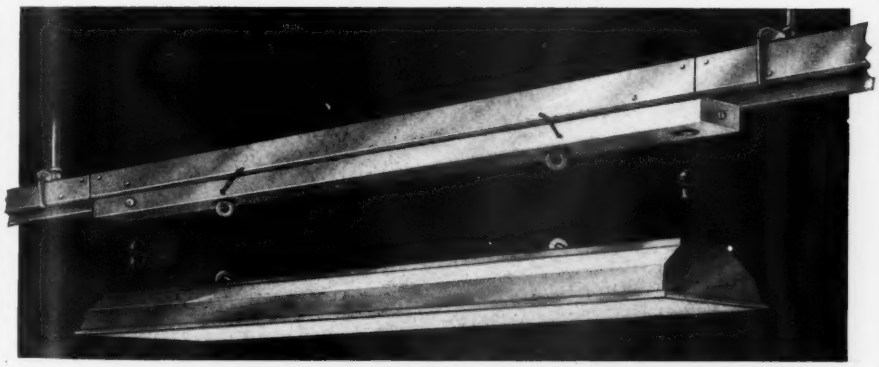
Trough slides along the top channel to give any spacing required.



Vitreous enamelled reflector in position.



Vitreous enamelled reflector ready to be unhooked. Lampholders disconnected. Trough with lamp lifted off hook by one man.



Vitreous enamelled reflector removed for cleaning. Trough and lamp taken off in one journey up the ladder in half the usual time.

Note: No live wires or terminals exposed.

Reflectors arranged 1" apart in continuous row.

Reflectors arranged with any space between.

Reflectors arranged for 1 or 2 Lamps as required.

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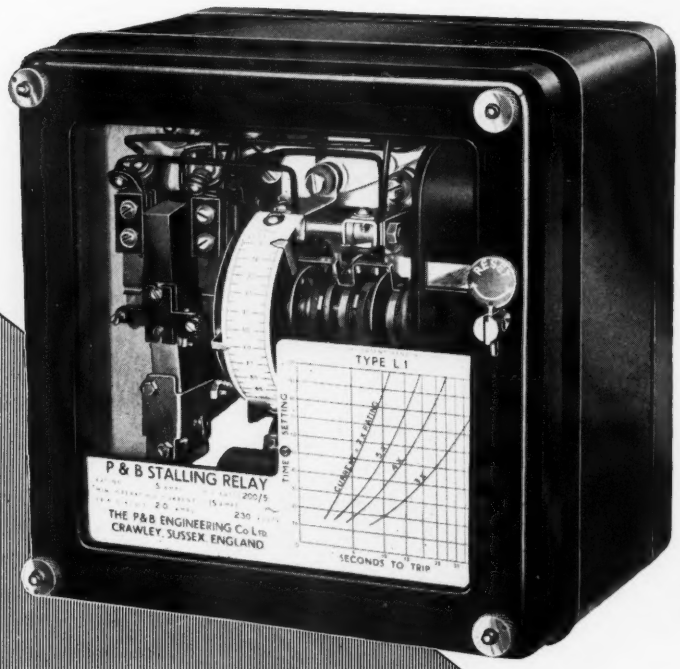

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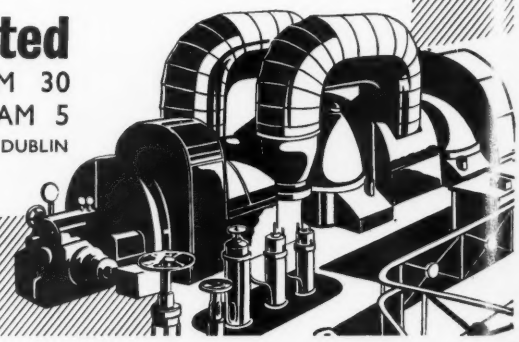

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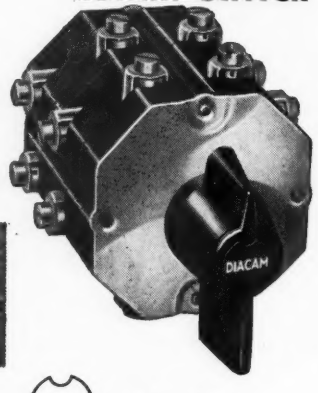

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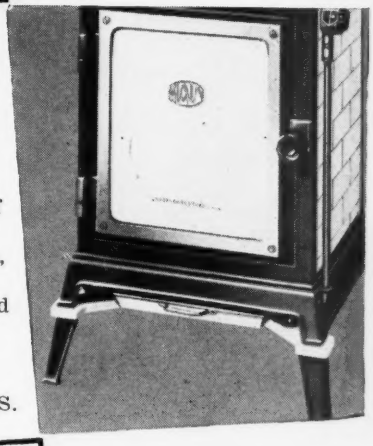
This is yet another example of how Streetly service has satisfied OLD FRIENDS.



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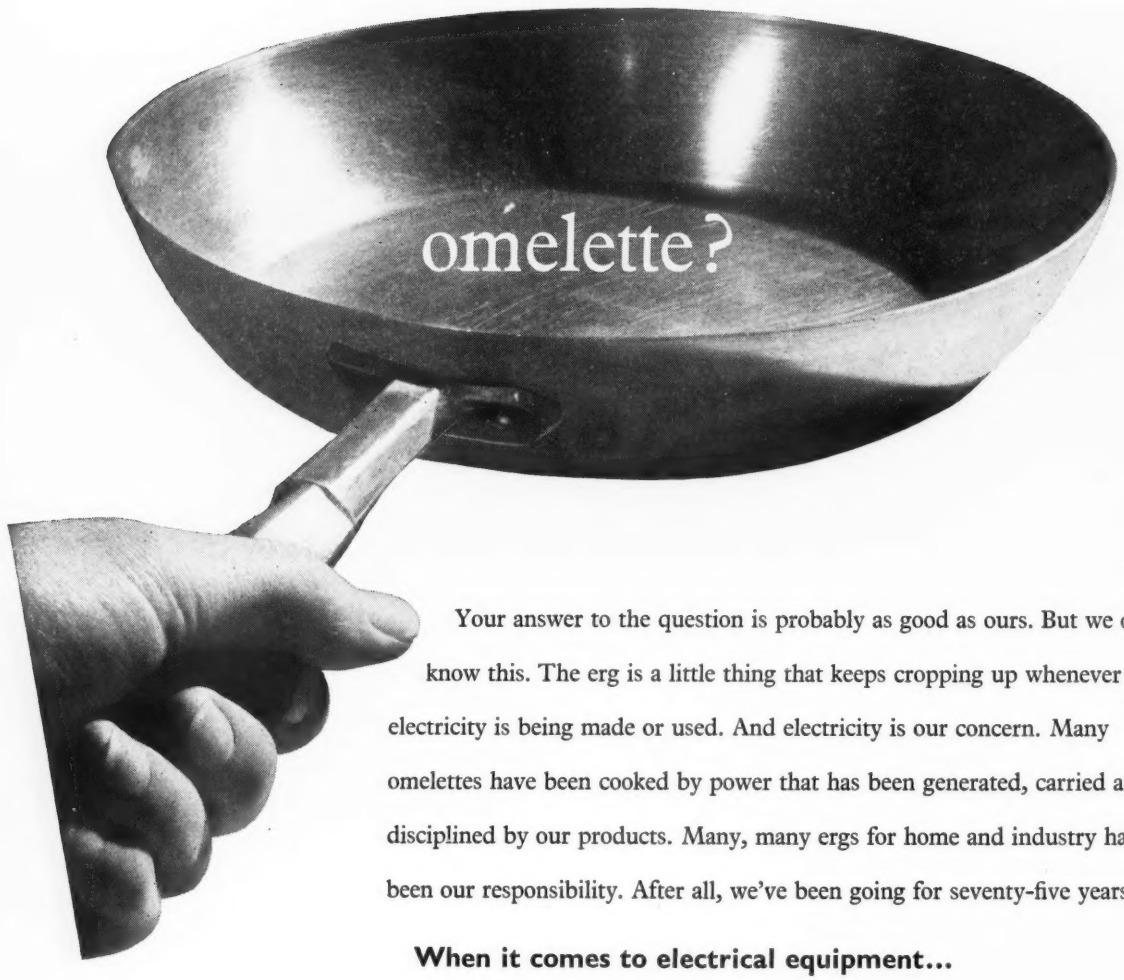
How many **ergs*** go to make an omelette?



Your answer to the question is probably as good as ours. But we do know this. The erg is a little thing that keeps cropping up whenever electricity is being made or used. And electricity is our concern. Many omelettes have been cooked by power that has been generated, carried and disciplined by our products. Many, many ergs for home and industry have been our responsibility. After all, we've been going for seventy-five years.

When it comes to electrical equipment...
You've got to hand it to

Crompton Parkinson LIMITED

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MAKERS OF ELECTRIC MOTORS OF ALL KINDS · ALTERNATORS · GENERATORS SWITCHGEAR · B.E.T. TRANSFORMERS · CABLES · INSTRUMENTS · LAMPS · LIGHTING EQUIPMENT · BATTERIES · STUD WELDING EQUIPMENT · TRACTION EQUIPMENT

*A footnote to remind you that the erg is the measurement of work done by the force of one dyne acting on a body through a distance of one centimetre. Take an erg to the seventh power of ten and you've got a joule, which is the work expended in a second by a current of one ampere flowing through one ohm . . . but why should we let that bother you?

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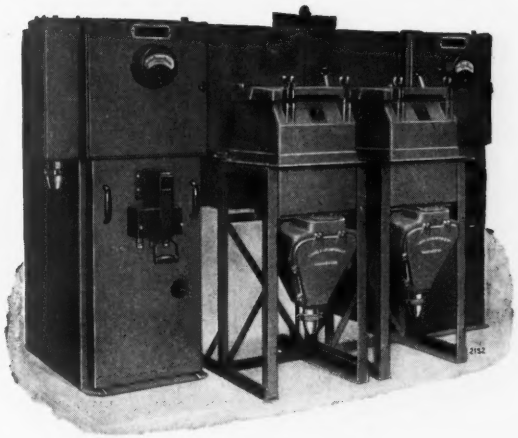
Two air insulated circuit breaker units and two oil fuse circuit breakers built into one board. Further extension with either type of unit.



The oil fuse circuit breaker is part of a versatile range of economical outdoor switchgear for 11 kV service.

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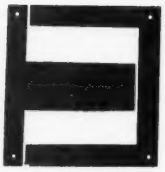

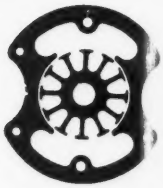

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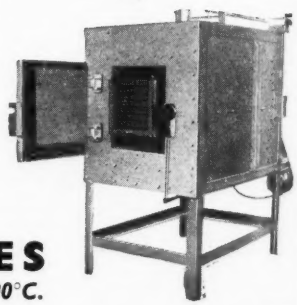

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FOR TEMPERATURES UP TO ***1400°C.***

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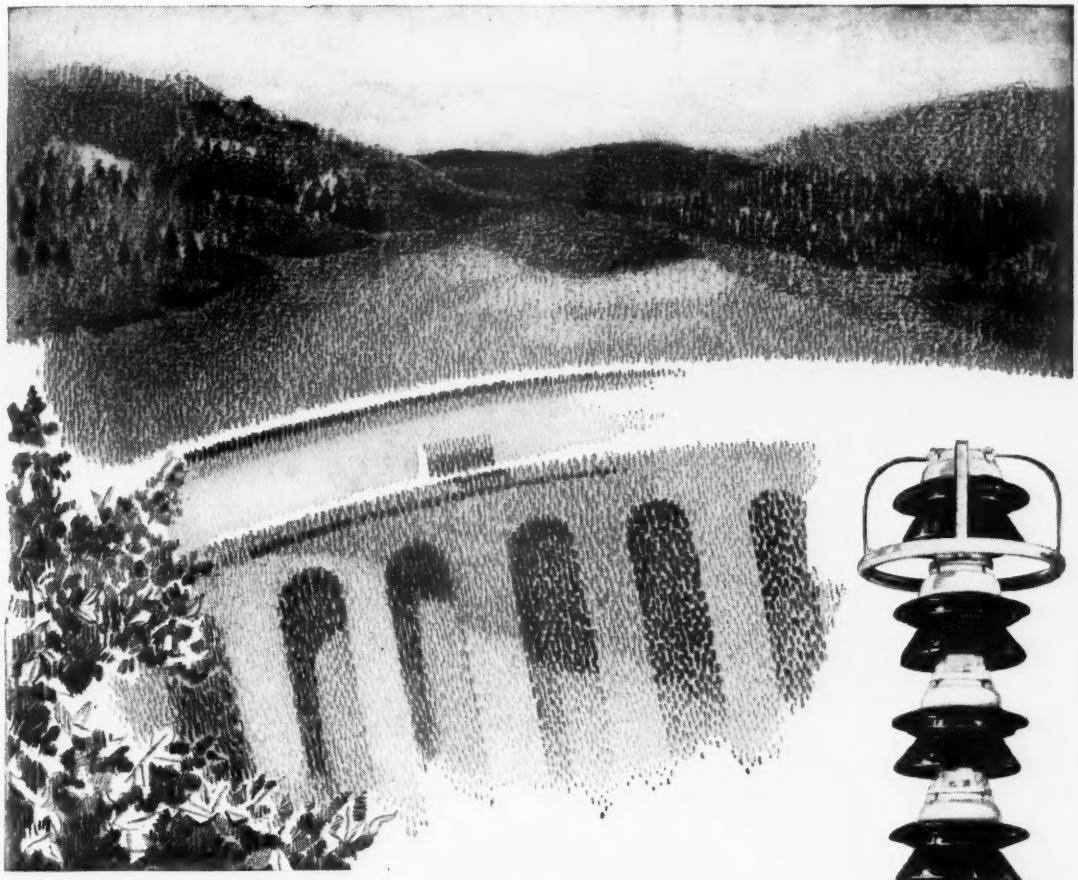

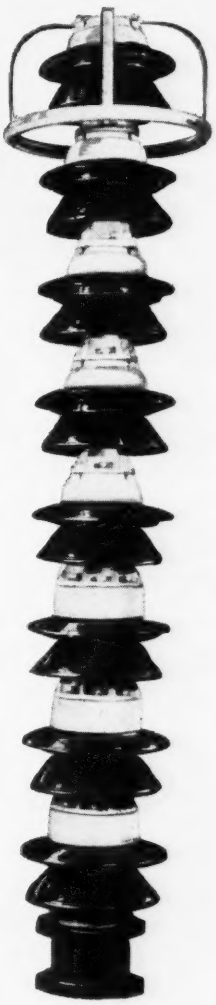

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who have a world-wide reputation

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A VERY POLITIC REASON FOR BECOMING AN

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Washing Machines
Standard Model—with *Automatic Wringer*
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Popular new 3.4 cu. ft. *Table-top* Model
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This new treatment inhibits scale deposits on all heated surfaces and gives maximum efficiency at minimum cost. The Belloid treatment is the result of extensive work by the Geigy Research Division arising from earlier successful collaboration with the Admiralty on scale control in marine evaporators.

A complete technical service is provided by the Ellis Research and Testing Laboratories Limited, Albury, Surrey. Telephone: Shere 341. Write or phone them; they will be glad to help.

Do away with tedious and expensive de-scaling!

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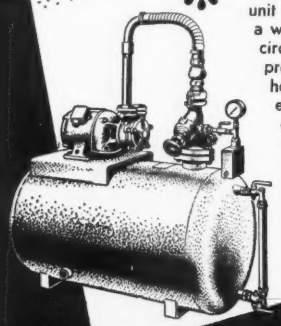

A compact, electrically operated unit to raise water from a well or borehole and circulate it at adequate pressure throughout the home, to farm buildings, etc. Inexpensive to operate, completely reliable and well worth remembering. May we send you descriptive leaflet PJ170 for your files?

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Remember to say Beresford Pumps, it pays in the long run

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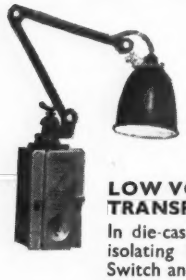

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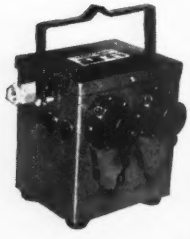
LOW VOLTAGE LIGHTING TRANSFORMER
In die-cast Aluminium Case, Self-isolating fitted with D.P. on-off Switch and H.R.C. Fuses to B.S.S. 794/38. Can be supplied with 1, 2 or 3 arm Lighting Brackets or Low Voltage Plugs and Sockets.

MEDIUM VOLTAGE ALL INSULATED TEST LAMP
100 — 500 Volts. A.C. D.C. Fitted with H.R.C. Fuses in each prod.



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For portable m/c tools, handlamps, etc., Secondary Voltages from 12 V — 110 Volts. Capacities from 50 V.A. to 750 V.A.

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For testing earth fault loop resistance —2 models available.

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AUTOMATIC STERILIZER

For Efficient Sterilization

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- In FIVE SIZES from 9" x 5" x 3" up to 20" x 10" x 7".

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Announce a new range of

FRACTIONAL HORSE POWER MOTORS

30 Years of design experience have gone into the development of this new range of Fractional Horse Power Induction Motors. The main physical dimensions of earlier frames have been maintained, but H.P. outputs have been increased.

We are specialists also in the following types of Fractional Horse Power machines:

Synchronous	**Rotary Converters**
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Two Speed Synchronous Hysteresis

We will be glad to furnish details on request.

Type JA with improved output efficiency for Shaded Poles, Synchronous or Squirrel Cage Induction Motors.

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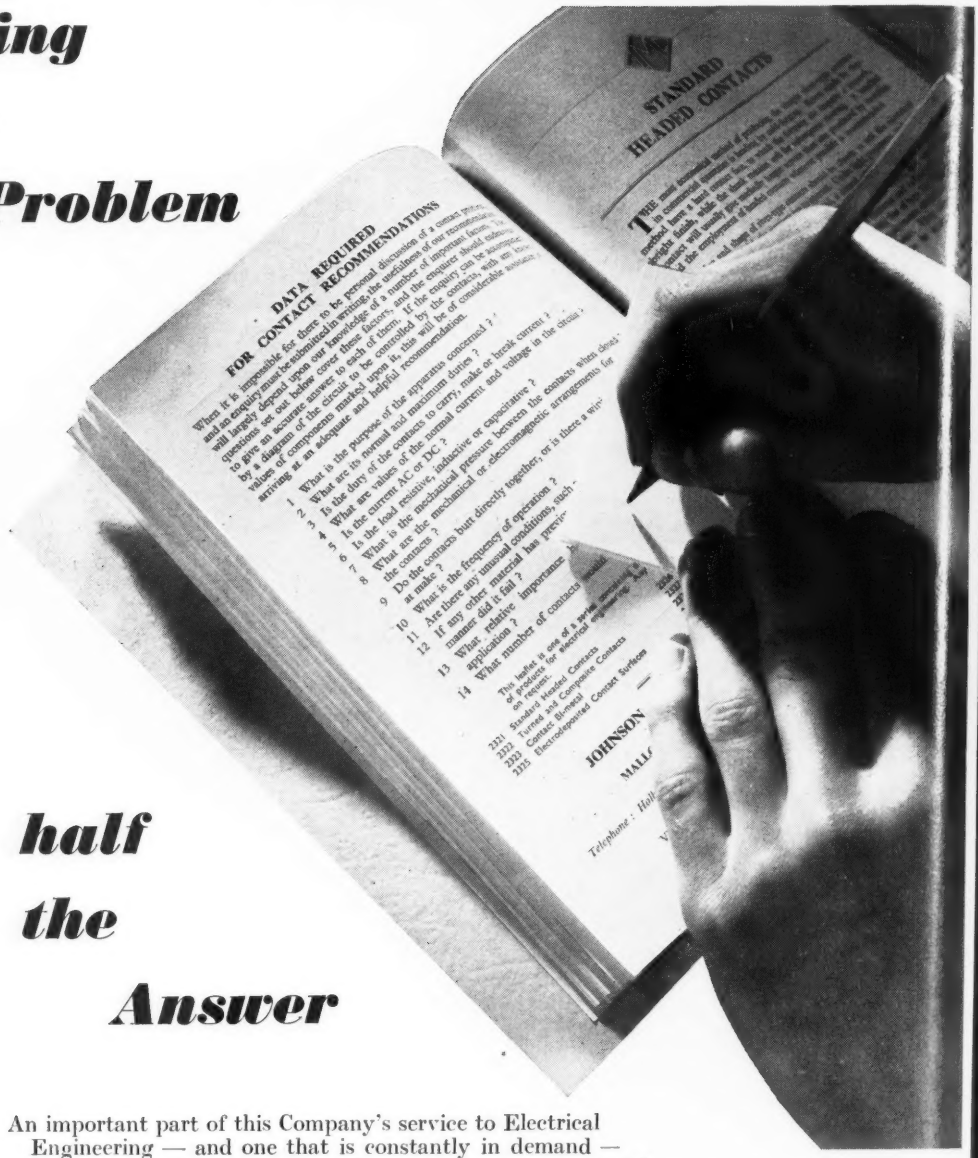

An important part of this Company's service to Electrical Engineering — and one that is constantly in demand — is the framing of recommendations for contact material and design.

But our long experience in this field can be used to full advantage only if the problem is clearly defined. Data Sheet 2320*, free on request, contains a short questionnaire covering the most important factors affecting contact performance.

Let us have the answers . . . . . and we'll answer *your* problem.

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MALLORY

* *One of a series of JMC technical publications dealing with electrical contacts. May we post you the complete set?*

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Specialised Equipment for POWER STATIONS

Condensing Plant
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Illustrated is a MIRRLEES Surface Condensing Plant operating in conjunction with a 25,000 kW Alternator in a South African Power Station.

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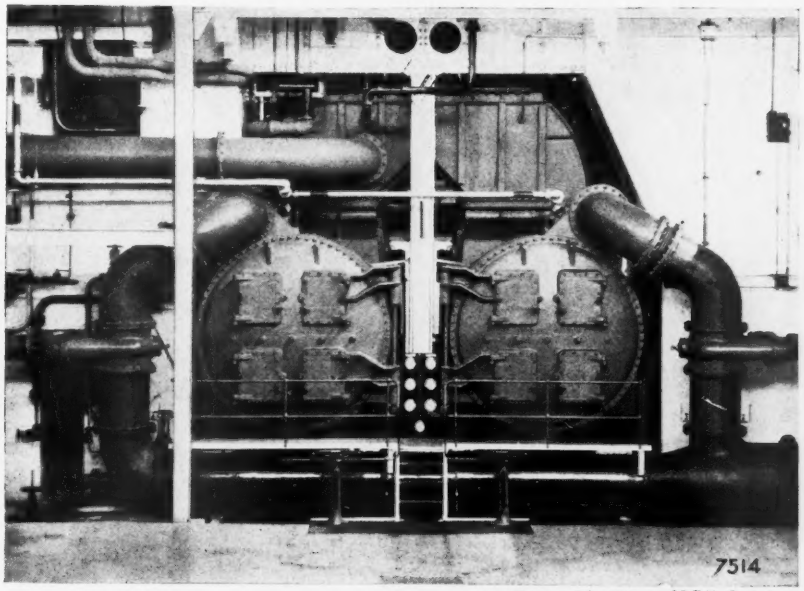

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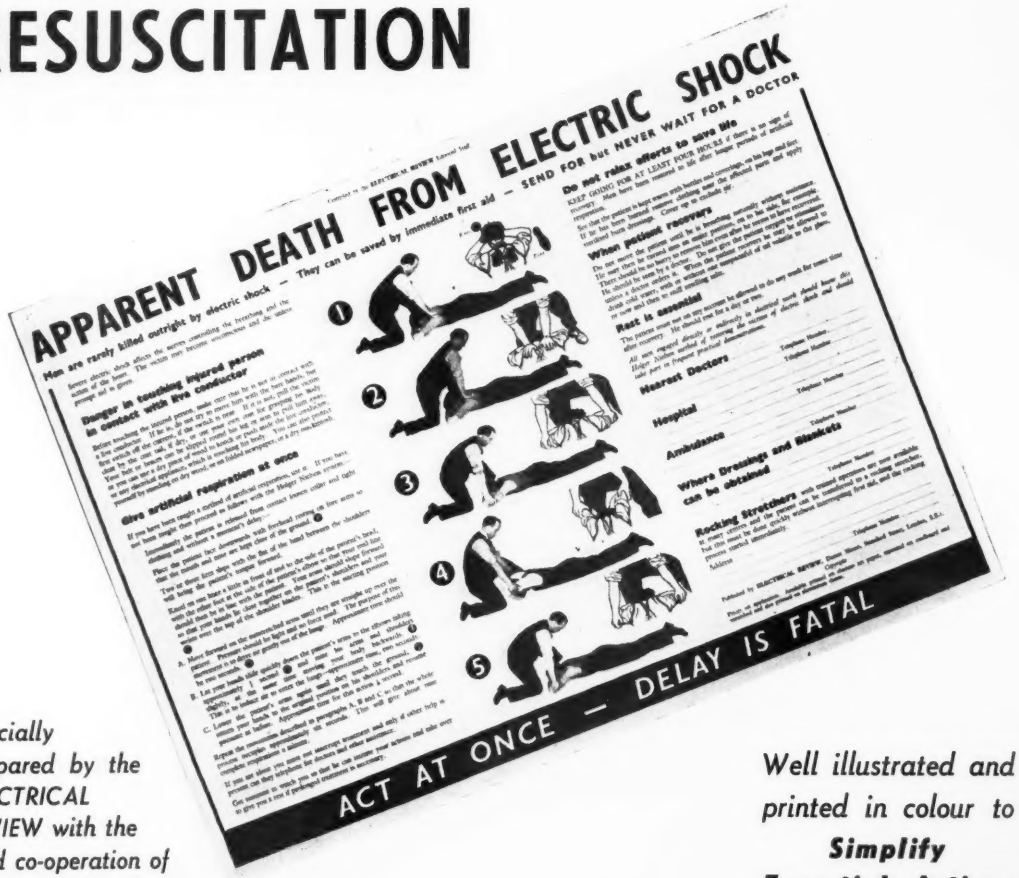
Based on the ***HOLGER NIELSEN*** *System*


APPARENT DEATH FROM ELECTRIC SHOCK
Men are rarely killed outright by electric shock — They can be saved by immediate first aid — SEND FOR but NEVER WAIT FOR A DOCTOR
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Give artificial respiration at once
Do not relax efforts to save life
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Nearest Doctors
Hospital
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Where Dressings and Blankets can be obtained
Rocking Stretchers
ACT AT ONCE — DELAY IS FATAL

Specially prepared by the ELECTRICAL REVIEW with the kind co-operation of Lt. Col. Holger Nielsen

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Aluminium Alloy Castings
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FOR FLUORESCENT LIGHTING

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

CLASSIFIED ADVERTISEMENTS

ADVERTISEMENTS are accepted up to **First Post on Monday** of the week of issue, and should be addressed to Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

CLASSIFIED advertisements are PREPAID at 3/- per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number this counts as two words and carries an additional charge of 1/-.

DISPLAYED:—£2 per inch, per insertion. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

BOROUGH OF GRANTHAM

Electric Street Lighting

TENDERS are invited for the supply and erection of 668 Concrete Lighting Columns and Wall Brackets, together with lanterns and control gear.

Specification and bills of quantities may be obtained from the Borough Engineer and Surveyor, Guildhall, Grantham, on payment of a deposit of £2 2s., which will be returned on receipt of a bona fide tender.

Tenders in plain sealed envelopes endorsed "Tender for Street Lighting" should reach the undersigned not later than 10 a.m. on Tuesday, 12th October, 1954.

JOHN F. GUILE,
Town Clerk.

Guildhall, Grantham.
September, 1954. 5079

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through the Local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order, 1952.

NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT of THIRD ASSISTANT ENGINEER (MAINS), CONSTRUCTION SECTION, CHIEF ENGINEER'S DEPT., AREA BOARD HEADQUARTERS, MANCHESTER.

Applicants should have had experience in the design, erection and/or laying of M.V. and H.V. overhead lines and underground cables up to and including 33 kV, together with experience in field survey.

A detailed knowledge of 33-kV cable joint design will be considered an advantage. Candidates should also have experience in the preparation of technical reports.

Salary scale £649/£790 rising subsequently to £883 p.a. Class AX/EX, Grade 5, N.J.B. conditions.

Applications to Establishments Officer, North Western Electricity Board, Cheetwood Road, Manchester, 8, by 25th September, 1954.

Appointment of THIRD ASSISTANT DISTRICT ENGINEER, SOUTH WEST FYLDE DISTRICT, BLACKPOOL.

Duties will include the operation, maintenance and construction of underground and overhead mains, substations and transformers and general mains work, including standby duty. Applicants should state their experience in high-voltage mains work. Possession of a Higher National Certificate in Electrical Engineering will be an advantage.

Salary scale £607/£629 p.a., Grade F.9, N.J.B. conditions.

Applications to the Sub-Area Manager, No. 4 Sub-Area, North Western Electricity Board, 40/41, Lune Street, Preston, by 25th September, 1954.

Appointment of SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEER, ROSSENDALE DISTRICT.

Duties will include control and supervision of industrial and domestic contract wiring, preparation of specifications, and installation, repair and maintenance of appliances on consumers' premises. Preference given to applicants who are Associate Members of the Institution of Electrical Engineers.

Salary scale £649/£681 p.a., Grade E.7, N.J.B. conditions.

Applications to Sub-Area Manager, No. 5 Sub-Area, North Western Electricity Board, Jubilee Street, Blackburn, by 25th September, 1954.

K

Appointment of SECOND ASSISTANT ENGINEER (SYSTEM PLANNING), SUB-AREA ENGINEER'S DEPT., CASTLE GREEN, KENDAL.

The successful applicant will be required to assist in system planning design, including the specification and ordering of switchgear and protective equipment, and will be responsible for investigations into system load flows, fault levels and relay settings. Applicants should preferably have had some experience in cable laying, overhead line erection, and in the design and construction of 11-kV and 33-kV substations. Preference given to applicants who hold Corporate Membership of the Institution of Electrical Engineers.

Salary scale £817/£852 p.a., Grade J.7, N.J.B. conditions.

Appointment of THIRD ASSISTANT DISTRICT ENGINEER, WHITEHAVEN DISTRICT.

Duties will be to assist the District Engineer in the control, construction, operation and maintenance of the H.V. and M.V. networks throughout the District. Experience in overhead distribution systems is essential. Preference given to applicants who hold Corporate Membership of the Institution of Electrical Engineers.

Salary scale £850/£887 p.a., Grade F.4, N.J.B. conditions.

Appointment of THIRD ASSISTANT DISTRICT ENGINEERS, PENRITH DISTRICT.

Applicants should be capable of preparing schemes and estimates for o/h and u/g construction up to 11kV by both direct and contract labour. A knowledge of the usual statutory and planning requirements is essential. Possession of the H.N.C. in Electrical Engineering would be an advantage.

Salary scale £561/£578 p.a., Grade D.9, N.J.B. conditions.

Applications for the above appointments to Sub-Area Manager, No. 6 Sub-Area, North Western Electricity Board, Castle Green, Kendal, by 25th September, 1954. 5087

SOUTHERN ELECTRICITY BOARD

Assistant Engineer (Planning)

ALDERSHOT District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class F, Grade 9 (£607 per annum). N.J.B. conditions of service.

The duties of the post will be to assist the planning engineer in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks, and will be required to undertake standby duties if required. The possession of suitable technical qualifications will be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him in envelopes suitably endorsed, not later than 8th October, 1954.

Demonstrator

Yeovil District of No. 4 (Bournemouth) Sub-Area. Salary N.J.C. Grade 1 (£400-£490 per annum). N.J.C. conditions of service.

Applicants should be women who are qualified to advise generally on the utilisation of electric domestic appliances, to give public demonstrations of apparatus and to assist in showroom duties. The possession of an E.A.W. Certificate or equivalent domestic science qualifications would be an advantage.

Applications on the standard form and in envelopes suitably endorsed, must reach the Sub-Area Secretary, 1, Priory Road, Bournemouth, not later than 1st October, 1954.

The successful candidates for the above appointments will be required to contribute to the B.E.A. and Area Boards Superannuation Scheme, if eligible. 5110

YORKSHIRE ELECTRICITY BOARD

No. 2 (Huddersfield) Sub-Area

HALIFAX DISTRICT.

DISTRICT SENIOR COMMERCIAL ASSISTANT (TODMORDEN). The successful applicant will be required to act, under the supervision of the Halifax District Commercial Engineer, as Local Manager at Todmorden. Candidates should be widely experienced in commercial matters, control of service centres and in public relations. Clerical and administrative experience will be an advantage.

Salary N.J.C. Grade 6, £730/£805 p.a.

Applications, giving full details of age, qualifications and experience, together with names of two referees, should be forwarded to the Manager, No. 2 (Huddersfield) Sub-Area, Yorkshire Electricity Board, Market Street, Huddersfield, not later than 30th September, 1954.

No. 5 (Wakefield) Sub-Area

CASTLEFORD DISTRICT.

THIRD ASSISTANT DISTRICT ENGINEER. Applicants must have had a sound practical training and considerable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground distribution networks, substation plant and ancillary equipment.

Applicants should hold a current driving licence and must be prepared to reside in the district and undertake standby duties.

Preference will be given to those who are Corporate Members of the Institution of Electrical Engineers or who hold equivalent qualifications.

Salary N.J.B. Class F, Grade 9, £607/£629 per annum.

Applications, giving full details of age, qualifications and experience, together with names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a, Denby Dale Road, Wakefield, not later than 30th September, 1954.

No. 6 (Hull) Sub-Area

DEMONSTRATOR. Applicants must have had a two years' full-time course in domestic subjects at a recognised training college, and possession of the E.A.W. Certificate will be an advantage. The successful candidate will normally be located at Hull, but may be required to work throughout the Sub-Area if occasion demands.

Salary N.J.C. Grade 1, £400/£490 p.a.

Applications, giving full details of age, qualifications and experience, together with names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, not later than 30th September, 1954. 5084

BRITISH ELECTRICITY AUTHORITY

South Eastern Division

ASSISTANT ENGINEER (PROJECTS), BRIGHTON A & B POWER STATIONS. The position requires initiative coupled with an analytical and enquiring mind, and the successful applicant will be engaged on projects designed to improve the efficiency of the power station in all aspects. He will be responsible for the initiation and carrying out of such schemes.

A sound knowledge of modern power station practice and the possession of Higher National Certificate or equivalent qualification are desirable.

N.J.B. conditions of service, Class L, Grade 9, £811 per annum.

Applications, giving details of education, present position, experience, etc., should be received by the Station Superintendent, Brighton Power Station, Portslade-by-Sea, Sussex, not later than 25th September. 5096

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

ASSISTANT MAINTENANCE ENGINEER (Electrical), Coventry Power Station (Vacancy No. 141/54/ER.). Applicants should have received a thorough technical and practical training with experience in testing protective gear, maintenance of alternators, transformers, switchgear and associated equipment.

Preference will be given to candidates who are Associate Members of a recognised Institution or possess similar qualifications.

Salary will be in accordance with Class G, Grade 8 (£678-£704 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications 28th September, 1954.

ASSISTANT SHIFT CHARGE ENGINEER, Northampton Power Station (Vacancy No. 142/54/ER.). Applicants should have had a sound technical training and be experienced in the operation of modern steam power stations. They should preferably hold a Higher National Certificate in Electrical or Mechanical Engineering.

The salary for the appointment will be in accordance with Class G, Grade 9 (£641-£667 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications 28th September, 1954.

SHIFT CONTROL ENGINEER, Avon Power Station, Warwick (Vacancy No. 144/54/E.R.). Applicants should have had some experience in power station control and have O.N.C. in Electricity.

Salary will be in accordance with Class E, Grade 10 (£555-£569 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications 5th October, 1954.

SENIOR DRAUGHTSMAN (Civil), Construction Department (Vacancy No. 112/54/ER.). Candidates should have experience in the preparation of detail drawings and in the design of one or more of the following subjects:—

Reinforced concrete structures.
Piled and slab foundations for heavy components.
Cable subways, bridges and culverts.

The salary will be in accordance with Grade 4 (£671-£780 per annum) or Grade 5 (£567-£671 per annum) of Schedule D of the National Joint Board Agreement.

Closing date for receipt of applications 5th October, 1954.

ASSISTANT SHIFT CHARGE ENGINEER, Freemen's Meadow Power Station, Leicester (Vacancy No. 143/54/ER.). Applicants should have experience in the operation of a large pulverised fuel fired station. The principal duties will be in the boiler house. Technical qualifications up to H.N.C. are desirable.

The salary will be in accordance with Class H, Grade 9 (£680-£706 per annum) of the National Joint Board Agreement.

The closing date for receipt of applications is 5th October, 1954.

These appointments will be pensionable within the terms and provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form A.E.6/ACT which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote vacancy number.

L. F. JEFFREY,
Divisional Controller. 5120

NORTH EASTERN ELECTRICITY BOARD

York Sub-Area

APPLICATIONS are invited for the appointment of SECOND ASSISTANT DISTRICT ENGINEER, Whitby District.

Salary, Schedule A, Class B, Grade 7, £559/£586, N.J.B. conditions of service.

Applications stating age, qualifications and experience should be forwarded to the Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. 5109

CITY COUNCIL OF SINGAPORE

Electricity Department

APPLICATIONS are invited for the post of CONSTRUCTION ENGINEER in the City Electricity Department on 3 years' agreement in the first instance. On satisfactory completion of the agreement the appointee would normally be offered emplacement on the permanent establishment.

Applicants must be Graduate Members of the Institution of Electrical Engineers or of the Institution of Civil Engineers, or equivalent. They must have experience in design, planning and construction of indoor and outdoor high-voltage substations involving specification of buildings and structural steelwork, etc. Minimum age 28 years.

The salary offered is $870, $910 and $950 a month for the 1st, 2nd and 3rd year respectively in the salary scale $870 × $40 to $990. Expatriation and cost-of-living allowances are also payable.

If placed on the permanent establishment after satisfactory completion of the agreement the basic salary will be $990 per month in the scale $870 rising to $990 per month (£1,218 to £1,386 per annum).

Expatriation allowance payable is £315 per annum on basic salary of $870 a month and £343 per annum on basic salary between $871 and $990 a month.

Cost-of-living allowance payable at present is £238 per annum on basic salary between $870 and $910 a month and £224 per annum on basic salary between $950 and $990 a month for a single man; £385 per annum on basic salary between $870 and $990 a month for a married man; £560 per annum on basic salary between $870 and $990 a month for a married man with one or more children. A dependent child means an unmarried child, including a step-child or a legally adopted child, under the age of 17, or receiving full-time educational instruction and below the age of 21.

For a single man the minimum total emoluments on a basic salary of $870 a month would amount to £1,771 per annum; for a married man with no children £1,918 per annum, and for a married man with one or more children £2,093 per annum.

The exchange rate is approximately $1 to 2s. 4d. sterling.

Partly furnished quarters provided if available at 6% of basic salary or housing allowance of 10% of basic salary (subject to a maximum of $120 per month) paid in lieu.

Free passages will be provided for appointee, his wife and his own children under the age of 12 years at the date of sailing subject to a maximum of three full passages.

One month leave per year of service may be granted on satisfactory completion of agreement at the discretion of the Council. If placed on the permanent establishment on completion of the agreement the appointee will be required to serve a further year before proceeding on leave. The present rate of leave is 4 days per month of resident service. Local leave of 14 days a year cumulative to a maximum of 28 days is also granted.

Compulsory provident fund contributions at present 7½% of salary (but not allowances), to which the Council donate 7½% rising to 10% after 10 years' service, 15% after 15 years' service, and 2% after 20 years' service. This scheme is under review.

Further details from the Council's London Agents: Messrs. Allen & Williams, 1, Victoria Street, Westminster, London, S.W.1. Closing date for full applications in duplicate, Thursday, 14th October, 1954. 5062

CHIEF ENGINEER

required to commence duty as early as possible and to control drawing office, development and design.

Must have technical and practical experience of switchgear up to 11 kV and preferably some knowledge of motor control gear. He must be a Member or Associate Member of the Institution of Electrical Engineers.

Good permanent and progressive position for the right man. Pension scheme in operation.

Apply by letter, marked personal, giving full particulars of experience, salary required, to Managing Director, Erskine, Heap & Co. Ltd., Lancashire Switchgear Works, Manchester, 7. 4911

SOUTH WEST SCOTLAND ELECTRICITY BOARD

Lanarkshire Sub-Area

(1) General Assistant Engineer (Sub-Area Planning & Development Dept.).
(2) General Assistant Engineer (Sub-Area Operation & Maintenance Dept.).

APPLICATIONS are invited for the above appointments. Candidates should preferably be Graduates of the Institution of Electrical Engineers or hold equivalent qualifications.

The salary and conditions of service for each appointment will be in accordance with the National Joint Board's Agreement, Schedule A. The present classification and grading for each appointment is stated below.

The successful candidates for the above appointments will require to reside within a reasonable distance of the Sub-Area Offices at Hamilton.

(1) General Assistant Engineer (Sub-Area Planning and Development Dept.). Applicants for this appointment should have had a sound engineering training, also a knowledge of short circuit calculations, load flow diagrams and voltage drop calculations, together with some experience in the design and layout of H.V. and L.V. underground and overhead distribution systems.

The present classification and grading for this appointment is K.13, salary £583/£605 per annum, which will be subject to the statutory deductions, including superannuation.

(2) General Assistant Engineer (Sub-Area Operation and Maintenance Dept.). Applicants for this appointment should have had a sound engineering training, also a knowledge of short circuit calculations, load flow diagrams and voltage drop calculations, together with some experience in the operation and maintenance of H.V. and L.V. distribution systems.

The present classification and grading for this appointment is K.13, salary £583/£605 per annum, which will be subject to the statutory deductions, including superannuation.

Application forms, which may be obtained from the undersigned or any other Sub-Area Manager, should be returned to this office within 14 days of the date of this notice.

DUGALD SMITH,
137, Almada Street, Manager.
Hamilton. 5095

PROFESSIONAL ENGINEERS IN VARIOUS GOVERNMENT DEPARTMENTS

THE CIVIL SERVICE COMMISSIONERS invite applications for pensionable posts in a wide variety of mechanical and electrical engineering duties. Provisionally the latest date for applications is 31st December, 1954, but an earlier date may be announced and early application is advised.

Candidates must be under 35 on 1st January, 1954, with extension for regular service in H.M. Forces and up to two years for permanent civil service. For the Post Office they must be at least 21, for the Ministry of Supply and Ministry of Transport and Civil Aviation at least 23, and for all other Departments at least 25 on that date.

Generally a candidate must possess a University Degree in Engineering or be a Corporate Member of one of the professional institutions —Mechanical Engineers, Electrical Engineers or Civil Engineers—or have passes in, or exemption from, Sections A or I and B or II of the corresponding Associate Membership examinations. Exceptionally, candidates of high professional attainment, but without the specified qualifications, may be admitted. For some posts Associate Fellowship of the Royal Aeronautical Society or an Honours Degree in Physics or Engineering will be accepted.

London salary scale (men) £650 (at age 25) to £1,000. Starting salary according to age up to £900 at 34. Candidates entering below age 25 will start at salaries varying from £450 at age 21 to £570 at age 24. Prospects of promotion. Salaries of next higher grades are £1,000-£1,320 and £1,375-£1,575. Somewhat lower for women and in the Provinces.

Further particulars and application forms from Civil Service Commission, Scientific Branch, 30, Old Burlington Street, London, W.1, quoting No. S85/54. 5059

SOUTH WESTERN ELECTRICITY BOARD

DISTRICT COMMERCIAL ENGINEER, EXETER. Salary N.J.B. Class E, Grade 4, £803 to £834 p.a.

Duties include responsibility to the District Manager for all commercial negotiations with the consumers, including the technical aspects; supervision of service centres and outside sales staff; control of installation contracting and consumers' service; organisation of exhibitions, demonstrations and publicity; preparation of revenue estimates. Candidates should possess extensive knowledge of, and have had wide experience in the commercial side of the industry and be capable of promoting a progressive commercial development policy. Corporate Membership of the I.E.E. is desirable.

Application forms obtainable from the Sub-Area Manager, 57, Paul Street, Exeter, should be returned by 2nd October, 1954.

SECOND ASSISTANT ENGINEER (PLANNING AND DEVELOPMENT), BRISTOL. Salary N.J.B. Class J, Grade 7, £807 to £852 p.a.

Candidates should have wide experience in the design, construction and operation of urban and rural systems comprising sub-stations, underground and overhead mains at voltages up to and including 33 kV. They should be capable of preparing distribution schemes and estimates and negotiating with consumers, local authorities and manufacturers of equipment. Corporate Membership of the I.E.E. is desirable.

Application forms obtainable from the Sub-Area Manager, Electricity House, Bristol, 1, should be returned by 2nd October, 1954.

SURVEYOR, AREA BOARD HEADQUARTERS, BRISTOL. Salary N.J.B. Schedule D, Grade 6, £433 to £567 p.a.

Applicants should have experience in practical surveying, employing a theodolite and dumpy level, preferably on overhead line work in the electricity industry. The successful candidate will be required to travel extensively throughout the Board's area, for which allowances are payable.

Application forms from Assistant Secretary (Establishments), Electricity House, Bristol, 1, to be returned by the 2nd October, 1954. 5112

EASTERN ELECTRICITY BOARD

Fens Sub-Area (140/54.R)

SECOND ASSISTANT ENGINEER (Planning and Development). Candidates should have had a wide experience in the design, layout and operation of urban and rural distribution systems comprising overhead and underground networks (including sub-stations) at voltages up to and including 33 kV. They should be experienced in the preparation of distribution schemes, including the technical design, specification and estimates. Corporate membership of the Institution of Electrical Engineers or the possession of a degree in electrical engineering will be an advantage.

Salary will be in accordance with Class H, Grade 6, of the National Joint Board Salary Agreement, commencing at £833, and future salary and conditions of service will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidate will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications by letter, stating age, education, qualifications and experience, with details of present appointment and salary, should be submitted to the Manager, Fens Sub-Area, Eastern Electricity Board, Milton Hall, Milton, Cambridge, within fourteen days of the appearance of this advertisement. 5104

BRITISH ELECTRICITY AUTHORITY

South Eastern Division

MAIDSTONE POWER STATION: STATION SHIFT CONTROL ENGINEER. Applicants should have had a sound technical education and experience in the operation of turbo-generators and control room duties. Class C, Grade 10, £502 p.a.

Applications, giving details of education, present position, experience, etc., should be sent to the Station Superintendent, Maidstone Power Station, Fairmeadow, Maidstone, Kent, not later than 25th September. 5101

BRITISH ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or D. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

SHIFT CHARGE ENGINEER, HACKNEY GENERATING STATION (Vacancy No. 54/772). Sound practical and technical training in electrical and mechanical engineering with practical experience in operation of power station plant. Experience of pulverised fuel an advantage. Salary Class F, Grade 7 = £731 17s. p.a.

ASSISTANT SHIFT CHARGE ENGINEER, WEST HAM GENERATING STATION (Vacancy No. 54/773). Sound practical and technical training in electrical and mechanical engineering, with practical experience in operation of power station plant. Salary Class H, Grade 9 = £714 p.a.

SENIOR DRAUGHTSMEN, ELECTRICAL ENGINEERING, DIVISIONAL HEADQUARTERS (Vacancy No. 54/774). With experience in the preparation of engineering drawings associated with the design, layout and construction of the electrical plant in a modern generating station, including the following: H.T. and auxiliary switchgear, generator transformers, motors and starters, associated diagrams, cable schedules, etc. Salary Grade 5 = £595 7s. to £704 11s. p.a.

ENGINEERING DRAUGHTSMEN, ELECTRICAL ENGINEERING, DIVISIONAL HEADQUARTERS (Vacancy No. 54/775). With experience in the preparation of drawings associated with the layout and construction of modern generating stations. To be able to prepare under supervision final or working drawings. Salary Grade 6 = £458 to £595 7s. per annum.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, British Electricity Authority, London Division, P.O. Box No. 136, Generation House, Great Portland Street, London, W.1, and be received within 14 days of this advertisement. 5097

BRITISH ELECTRICITY AUTHORITY

GENERATION Design Branch, Headquarters, London, require a PRINCIPAL ASSISTANT ENGINEER in the Station Development Sub-Branch, which is mainly concerned with the planning, siting and negotiation of facilities and consents for new and extended power stations and for the launching of these projects within the Authority's organisation.

Candidates should possess an honours degree or be Corporate Members of either the I.Mech.E. or the I.E.E. and have sound experience of power station design. A knowledge of the selection of sites for new power stations and experience of supervising negotiations would be an advantage.

Salary within N.J.M., Scale 4, £1,650-£1,800 inclusive.

Application forms from D. Moffat, Director of Establishments, Winsley Street, London, W.1, to be completed and returned by 28th September, 1954. Quote ref. ER/518. 5030

BRITISH ELECTRICITY AUTHORITY

THIRD ASSISTANT ENGINEER required in the Research Sub-Department at Headquarters in London. Candidates should have at least three years' industrial experience and should preferably be Graduate Members of the I.E.E. or the I.Mech.E. The post demands a sound knowledge of the general principles underlying electricity supply techniques rather than any specialised skill.

Candidates should be interested in engineering development and have some mathematical ability and be mentally adaptable. There is unlikely to be much scope for experimental work, but familiarity with the aims and methods of research is desirable.

Salary N.J.B. Grade 4, £753-£981 inclusive.

Applications, stating age, qualifications, experience, present position and salary, should be forwarded to D. Moffat, Director of Establishments, Winsley Street, London, W.1, by 4th October, 1954. Quote ref. ER/517. 5031

STATION ENGINEERS AND STATION ENGINEERS (MECH.)

required by AIR MINISTRY at R.A.F. and M.C.A. stations. Qualifications and experience required: (a) Ordinary National Certificate in either Electrical or Mechanical Engineering as appropriate, or equivalent standard of technical education; (b) Recognised apprenticeship in either electrical and/or mechanical engineering; (c) Three years' responsible engineering employment, preferably on operation and maintenance of mine, factory or workshop plant and services.

Supervisory experience an advantage as duties entirely supervisory and cover installation, operation and maintenance of high and medium voltage distribution system, internal electrical installations, diesel and boiler house plant, steam and hot water heating systems, and other miscellaneous installations, tools and equipment.

In the case of Station Engineers (Mech.) duties are of more specialist nature and cover mechanical items only.

Commencing salary according to age, qualifications and experience (normally £550 at age 28 or over) on the range £510 to £640. Appointments include liability for service overseas for which special allowance payable in addition to higher salary. Appointments non-pensionable. Only natural-born British subjects.

Write, giving date of birth, education, full details of qualifications and experience of posts held (including dates) to E.A.1564/AA, Appointments Officer, Ministry of Labour and National Service, 1-6, Tavistock Square, London, W.C.1, by 30th September, 1954.

No original testimonials should be sent. Only candidates selected for interview will be advised. 5033

GOLD COAST LOCAL CIVIL SERVICE

Senior Electrical Engineer

Electricity Department, Gold Coast

A VACANCY exists for a SENIOR ELECTRICAL ENGINEER in the Local Civil Service of the Gold Coast.

Duties are to take charge, under the Chief Electrical Engineer, of the operation and maintenance of electricity supplies at voltages up to 11,000 volts. Appointment is on contract for 2 tours in the salary range £2,190-£2,310 per annum. A gratuity of £37 10s. is payable for each completed 3 months' satisfactory service.

Free first class passages are provided for the officer, his wife, and up to 3 children under 13 years of age. Government quarters, if available, are provided at a rental of £120 per annum. Leave is granted at the rate of 7 days for each completed month of resident service after a tour of 18-24 months.

Candidates must be A.M.I.E.E. and have had at least 10 years' experience since passing or becoming exempt from sections A and B of the Institution's examination. They should have been regularly trained as electrical engineers and have had a wide subsequent experience with an electricity supply authority in the construction and maintenance of E.H.T. and L.T. underground and overhead distribution systems and consumers' installations. A knowledge of compression ignition engines is desirable.

Apply in writing to the Director of Recruitment, Colonial Office, Great Smith Street, London, S.W.1, giving briefly age, qualifications and experience. Mention the reference number CDE/145/13/04/D11. 5108

BOROUGH OF SWINDON

APPLICATIONS are invited for the position of ELECTRICAL AND MECHANICAL ENGINEER in the Department of the Borough Engineer and Water Engineer, at a salary in accordance with A.P.T. Grade VIII (£785 × £25 to £860).

Candidates should have A.M.I.Mech.E. or A.M.I.E.E. qualification, and possession of a university degree in engineering would be an advantage. Preference will be given to applicants who, in addition to mechanical and electrical engineering experience, have had experience in large heating installations.

HOUSE ACCOMMODATION is available.

Applications on forms obtainabe from the Town Clerk, Civic Offices, Swindon, must be returned by 2nd October, 1954. 5080

Belfast Education Committee

COLLEGE OF TECHNOLOGY

Principal: D. H. Alexander, O.B.E., M.Sc., Wh.Sch., M.I.MechE., M.I.Mar.E.

Physics and Electrical Engineering Department

LECTURER IN ELECTRONICS

APPLICATIONS are invited for the position of LECTURER IN ELECTRONICS.

Applicants should hold an Honours Degree, or its equivalent, with special qualifications in Electronics, preferably combined with Physics and/or Mathematics, but applicants with degrees in Electrical Engineering will also be considered. Industrial or research experience will be an added qualification.

For applicants who hold a recognised honours degree, the scale of salary is £606, rising by annual increments to £1,030 per annum. In fixing the commencing point on the scale, allowance will be made for previous teaching and industrial experience.

Further particulars and form of application may be obtained from the Principal, College of Technology, with whom applications must be lodged not later than Friday, 29th October, 1954.

J. STUART HAWNT,
Director of Education. 5107.

CHARTERED ELECTRICAL ENGINEER

required by a large retail organisation of national repute, to advise the Chief Architect, to whom he will be directly responsible, on the design, installation and general work concerning the lighting of shops. Previous experience of modern lighting design is essential and a knowledge of heating and ventilating would be an advantage. Age not over 40. Salary £1,500 or higher will be offered according to experience. The post is pensionable.

Applications, by letter only, giving full details of experience, should be addressed to:—

The Secretary
THE PROFESSIONAL ENGINEERS APPOINTMENTS BUREAU
9, Victoria Street, Westminster, London, S.W.1

5117

MIDLANDS ELECTRICITY BOARD

DEMONSTRATOR (Female) required in the Banbury District. Applicants must have had good education and should have a certificate of a recognised domestic training college and/or the E.A.W. Certificate. Duties include lecture demonstrations in service centres and on consumers' premises and advising consumers on the selection and use of electrical appliances.

Salary £400/£490 per annum (N.J.C. Grade 1). Superannuable.

Applications, stating age, education, qualifications, training and experience, should be forwarded, within fourteen days, to the Sub-Area Manager, Midlands Electricity Board, Whittington, Worcester.

A. STEPHENS, Secretary.
5103

IMPERIAL COLLEGE

APPLICATIONS are invited for post of LECTURER IN ELECTRICAL ENGINEERING. Salary scale £600 × £50 to £900; £50 to £1,150. F.S.S.U. and family allowances. Candidates should possess a good honours degree in electrical engineering and preferably have completed a Graduate Apprenticeship. Initial salary, according to experience and qualifications, will be at the lower end of the salary scale.

Applications, stating age, academic qualifications and experience, together with the names of two referees, should reach the Head of the Electrical Engineering Department, City and Guilds College, London, S.W.7, not later than 1st October, 1954. 4956

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointments:—

(a) STATION CLERK, TILBURY GENERATING STATION. Salary Grade 5 of the N.J.C. Salary Agreement, £670 × £20 to £730 per annum plus London weighting.

(b) STATION CLERK, GOLDRINGTON GENERATING STATION, BEDFORD. Salary Grade 4 of the N.J.C. Salary Agreement, £605 × £20 to £655 per annum

Both generating stations are at present under construction and when completed will be of 360-MW and 180-MW capacity respectively.

Applicants should have had wide experience in administrative and accounting duties at a generating station, knowledge of mechanised accounting systems, and a recognised qualification (e.g. Cost and Works Accountants) would be an advantage.

Applications, stating age, qualifications, experience and present position, should be sent to the Controller, Northmet House, Southgate, London, N.14, not later than the 4th October, 1954.

W. N. C. CLINCH,
Controller. 5081

APPLICATION ENGINEERING

APPOINTMENTS are available with THE ENGLISH ELECTRIC COMPANY LIMITED, on important work covering Application Engineering on all classes of electrical equipment. These appointments are pensionable after a qualifying period and apprentice trained men with Higher National Certificate in Electrical or Mechanical Engineering or equivalent, and with previous experience on Application work are preferred.

Experience in the manufacturing or power supply industries or in the application or installation of electrical equipment in any branch of industry or engineering is an alternative qualification and professional engineers in these fields are also invited to apply.

A number of vacancies also exist for apprentice trained engineers seeking an opportunity of acquiring Application Engineering experience. Reply stating age, experience, qualifications, and quoting Ref. S.A. 33D., to—Dept. C.P.S., 336/7, Strand, London, W.C.2.

4945

BORD NA MONA

Vacancy for Junior Electrical Engineer

A VACANCY exists for a JUNIOR ELECTRICAL ENGINEER on a salary scale of £525 × £26 10s. to £858 15s.

Applicants must possess technical qualifications up to A.M.I.E.E. standard and should preferably have some works experience.

Application, stating age, qualifications and experience, should reach the Secretary, Bord na Mona, 28-31, Upper Pembroke Street, Dublin, not later than 27th September, 1954.

5115

RADIO MECHANIC

required for the BERMUDA POLICE FORCE in the rank of Constable for a tour of 5½ years with possibility of permanency. Salary scale (including present temporary allowance of 10% of salary) £715 rising to £825 a year. Free passages and uniform. No income tax.

Candidates must be UNMARRIED, between 21 and 28 years of age, of sound physique and good education. They must be familiar with signal generator, valve tester, anometer and battery charger equipment, and also V.H.F. equipment similar to Pye Series PTC704 (fixed unit) and Pye Series PTC115 (mobile units).

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M1/36551/EF. 5032

LONDON ELECTRICITY BOARD

Senior Draughtsman

APPLICATIONS are invited for the above position in the Design and Planning Branch of the Northern Sub-Area at Aldersgate, London, E.C.1.

Applicants should have had training and experience in building construction and the design of steelwork and reinforced concrete structures, and be capable of preparing drawings and making calculations for the alteration of existing premises and the conversion of basements into substations and transformer chambers. Experience in the layout of electrical equipment up to 11 kV, whilst not essential, would be an advantage.

The post is graded under Schedule D of the National Joint Board Agreement as Grade 5, £595 7s. to £704 11s. per annum, inclusive of London allowance.

Application forms obtainable from Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed within ten days of the publication of this advertisement. Please enclose addressed envelope and quote ref. V/16:2/R on all correspondence. 061

SEMI-CONDUCTORS

THE following personnel are required for development of new types of transistors and other semi-conducting devices, improvements of existing types and development of methods of manufacture:—

DEVELOPMENT ENGINEERS, for work on development and engineering control of production of semi-conducting devices. Qualifications science or engineering degree, preferably with factory experience.

EQUIPMENT ENGINEERS, for development of equipment for assembly and testing. Qualifications engineering degree or H.N. Certificate, preferably with factory experience.

DRAUGHTSMEN, for jig and tool design and machine layout work.

RADIO MECHANICS, for building, calibration and servicing of test equipment, including V.H.F.

Applications, stating age, qualifications and previous experience, to the Superintendent, British Thomson-Houston Co. Ltd., Lutterworth, Rugby. 5034

BRITISH ELECTRICITY AUTHORITY

Yorkshire Division

APPLICATIONS are invited for the appointment as SECOND ASSISTANT ENGINEER (Mechanical) in the Generation Construction Department, Rotherham.

The commencing salary will be within the salary range £834-£1,083 per annum, Grade 2, Class AX/EX, N.J.B. Agreement (Schedule C), according to qualifications and experience.

Applicants should preferably be Corporate Members of the Institution of Mechanical Engineers or possess equivalent qualifications. They should be experienced in power station design and construction, with particular reference to turbo-alternators, boilers, coal and ash handling plant, high-pressure steam and water piping, and other ancillary work, and should also have knowledge of the preparation of schemes, specifications and estimates.

Application forms may be obtained from the Divisional Secretary (Establishments), British Electricity House, St. Mary's Road, Leeds, 7, and should be returned within 14 days of the appearance of this advertisement.

G. A. VOWLES,
Divisional Controller.
5102

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

APPLICATIONS are invited for the post of GENERAL ASSISTANT ENGINEER on distribution work in North Caledonia Area. Salary £466/£548, N.J.B. Class F, Grade 13/11, according to qualifications and experience. Superannuation scheme applicable.

Applications, stating age, qualifications and experience, to be forwarded to Area Manager, West Villa, Elgin, Morayshire, by 27th September, 1954. 5082

POWER STATION ENGINEER

A POWER STATION ENGINEER is required to supervise, under the direction of the Site Manager, the following work in connection with a major steel works development scheme:—

(1) The work of contractors engaged in the erection of power station plant comprising high-pressure boilers, turbo-alternators, turbo-blowers and pumping plant, including cooling towers and water re-circulation systems.

(2) The design and installation in collaboration with the works technical staff and contractors of the necessary high-tension switchgear, main cabling and sub-stations.

The appointment is permanent and superannuable, and the holder will be expected to take charge of the subsequent operation and maintenance of the above plant.

Applicants should forward full personal particulars, with details of academic or professional qualifications and practical experience, together with salary required. Write—1196, Wm. Porteous & Co., Glasgow. 5116

BRITISH ELECTRICITY AUTHORITY

Headquarters, London

SECOND ASSISTANT ENGINEER required in the Operational Assessment and Analyses Sub-Branch of the Generation Operation Branch. Duties will be concerned with operational research and will involve the detailed examination and analyses of the performance of generating plant and the study of methods of improving efficiency and availability.

Candidates should preferably hold a university degree or the equivalent and be Corporate Members of either the I.E.E. or I.Mech.E. Some years' practical experience in power stations, preferably including maintenance work, is desirable.

Salary N.J.B. Grade 3, £840-£1,209 p.a. inclusive.

Applications, stating age, qualifications, experience and present position and salary, should be forwarded to D. Moffat, Director of Establishments, Winsley Street, London, W.1, by 30th September, 1954. Quote ref. ER/523. 5099

INSTRUCTOR IN GENERAL ELECTRICAL ENGINEERING

required by the MOMBASA INSTITUTE OF MUSLIM EDUCATION, KENYA, for one tour of 3 years in the first instance, with prospect of further employment by mutual agreement. Salary scale (including present temporary allowance of £165/£300 a year) £715 rising to £1,325 a year. Commencing salary according to age, qualifications and experience. Outfit allowance £30. Contributory superannuation scheme. Free passages and free furnished quarters. Liberal leave on full salary.

Candidates, between 23 and 35 years, should have served an appropriate apprenticeship and have wide subsequent practical experience, including outside wireman's work. They must be capable of instructing in all forms of general electrical engineering, both in theory and in practice, and should hold a C. & G. Certificate or equivalent qualification.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/30683/EF. 5114

SOUTH EASTERN ELECTRICITY BOARD

SHOWROOM ASSISTANT (Male or Female), Crawley District.

Salary, male, £250 p.a. at age 20 to £395 p.a. at age 26, rising subject to satisfactory service to £470 p.a. Female, £203 p.a. at age 20 to £320 p.a. at age 26, rising subject to satisfactory service to £380 p.a. Applicants must have electrical showroom experience and be able to deal with tariffs, consumers' enquiries, have knowledge of electrical apparatus and ability and initiative to promote sales.

Applications, naming 2 referees, to F. A. Avery, A.I.E.E., Crawley District, Manager, SEEBoard, 55, High Street, Crawley, by 29th September, 1954.

A. L. BURNELL,
Secretary.
5113

WOLVERHAMPTON & STAFFORDSHIRE TECHNICAL COLLEGE

Principal: C. L. Old, B.Sc.(Eng.), M.Sc.Tech.

APPLICATIONS are invited for the post of ASSISTANT LECTURER Grade B in Electrical Engineering.

Applicants must have industrial experience and possess suitable qualifications.

Salary in accordance with the Burnham Technical Report, viz., £525 to £820 p.a., with allowances for degree, training, etc.

Duties to commence 1st January, 1955.

Further particulars and forms of application may be obtained from the undersigned by sending a stamped addressed foolscap envelope. Completed applications to be returned as soon as possible.

G. W. R. LINES,
Clerk to the Joint
Education Committee.

Education Offices,
North Street,
Wolverhampton. 5045

BRITISH ELECTRICITY AUTHORITY

Midlands Division

SECOND ASSISTANT ENGINEER (Mechanical) is required in the Generation (Construction) Department at Divisional Headquarters, Birmingham. N.J.B. service conditions, superannuable appointment, salary within Schedule C, Grade 2, of the agreement, commencing in range £834 to £970 and ultimately rising to £1,053 per annum.

Applicants should have had a recognised training in mechanical engineering and a thorough experience in the design and installation of mechanical equipment for power stations, including the preparation of specifications. Applicants should preferably be Corporate Members of the Institution of Mechanical Engineers.

Apply, quoting Vacancy No. 760MD, on form AE6, available from the Establishments Officer, 53, Wake Green Rd., Moseley, Birmingham, 13, by 2nd October, 1954. 5118

BRITISH ELECTRICITY AUTHORITY

North Eastern Division

APPLICATIONS are invited for the appointment of STATION CHEMIST at Darlington Power Station.

Applicants should have had experience in modern power station laboratories covering the analysis of fuel water and oil and be conversant with water treatment and fuel sampling, and should possess at least a Higher National Certificate in Chemistry.

The salary for this appointment (which is superannuable) will be in accordance with the National Joint Board Agreement, Schedule A, Grade 7, Class F (£697-£718 per annum).

Forms of application may be obtained from the Divisional Establishments Officer, British Electricity Authority, North Eastern Division, Carliol House, Newcastle upon Tyne, to whom they should be returned to arrive not later than 28th September, 1954. 5083

METROPOLITAN-VICKERS ELEC. CO. LTD.

require DESIGN DRAUGHTSMEN for METALCLAD and HIGH VOLTAGE SWITCHGEAR DEVELOPMENT.

Senior and junior positions available according to experience.

Applications, giving details of experience, age, etc., should be addressed to the Personnel Manager, Metropolitan-Vickers Elec. Co. Ltd., Trafford Park, Manchester, 17.

4912

DESIGNER-DRAUGHTSMEN (ELECTRICAL AND MECHANICAL)

wanted for work in connection with special variable speed drives and automatic devices for newspaper printing machines. Only senior men required, preferably with similar experience. Enhanced salaries will be paid to suitable men. Canteen facilities, contributory pension scheme. Write stating experience and salary required to Witton-James Ltd., The Hyde, Hendon, London N.W.9. 5063

BRITISH ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for the following position: STATION SUPERINTENDENT, MARCHWOOD GENERATING STATION (480 MW when completed).

Applicants should have received a thorough technical and practical training, followed by wide experience in the operation and maintenance of generating station plant, and have also held a position of responsibility involving the control of technical and administrative staffs. Preference will be given to corporate members of one of the senior professional engineering institutions, or those holding similar qualifications.

Salary N.J.M. Grade 3, £1,450-£1,600.

Special application forms, obtainable from P. D. A. Oliver, Divisional Secretary, High St., Portsmouth, should be returned not later than 8th October, 1954. 5100

BRITISH ELECTRICITY AUTHORITY

North West, Merseyside and North Wales Division

VACANCY No. 166/54R: FIRST ASSISTANT STATION CHEMIST, Ribble Generating Station, Preston. Salary £680/£706 (H.9). Closing date 6th October.

Vacancy No. 167/54R: STATION SHIFT CONTROL ENGINEER, Barrow. Salary £531/£547 (D.10).

Vacancy No. 168/54R: STATION SHIFT CONTROL ENGINEER, Padiham, near Burnley. Salary £555/£569 (E.10).

Vacancy No. 169/54R: SHIFT CHARGE ENGINEER, Wigan. Salary £633/£643 (D.7).

Closing date 25th September.

Applications, quoting vacancy number, to Controller, British Electricity House, 825, Wilmslow Road, Manchester, 20. 5088

BRITISH ELECTRICITY AUTHORITY

TRANSMISSION Design Branch, Headquarters, London, require a THIRD ASSISTANT ENGINEER (Protective Gear) in the Plant and Equipment Design Sub-Branch.

Candidates should have all-round experience in the theory and practice of modern types of protective gear for large high-voltage systems, a general knowledge of electrical plant characteristics, and be accustomed to the preparation and interpretation of complex wiring diagrams. Engineering and education qualifications equivalent to A.M.I.E.E. standard are essential.

Salary N.J.B. Grade 4, £753-£981 p.a. inclusive.

Applications, stating age, qualifications, experience, present position and salary, should be forwarded to D. Moffat, Director of Establishments, Winsley Street, London, W.1, by 30th September, 1954. Quote ref. ER/519. 5060

BRITISH ELECTRICITY AUTHORITY

Midlands Division

ASSISTANT MAINTENANCE ENGINEER (Electrical) is required at Walsall Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade H.8, commencing at £717 per annum.

A sound technical training and experience in power station electrical maintenance required, and preferably the possession of appropriate qualifications.

Apply, quoting Vacancy No. 759MD, on form AE6, available from the Establishments Officer, 53, Wake Green Rd., Moseley, Birmingham, 13, by 2nd October, 1954. 5119

CONTACTOR SWITCHGEAR LTD.

ENGINEERS required for both Engineering and Estimating Departments for control gear applications up to 1,000 h.p. low and high tension.

The company operates a contributory pension scheme and will share cost of removal in approved cases.

Applicants should have completed their National Service and preferably not over 45.

Write in confidence to the Secretary, Blakenhall, Wolverhampton. 5111

TECHNICIAN AND DESIGNER/ DRAUGHTSMEN REQUIRED

A FIRM manufacturing medium voltage electrical distribution equipment and located on Merseyside requires the following additional staff:—

TECHNICIAN to translate customers' requirements into specifications for contracts and drawing office departments. H.N.C. in electrical engineering desirable together with practical distribution gear experience; salary £600/£650 p.a.

DESIGNER/DRAUGHTSMEN for design and development work, mainly mechanical but requiring a sound knowledge of basic electrical technology; salary £650/£750 p.a.

The posts are pensionable. Please apply, stating age, qualifications and experience, to—Box 2J J. 7458, A.K. Advg., 212a, Shaftesbury Ave., London, W.C.2. 5105

BRITISH ELECTRICITY AUTHORITY

South Western Division

TECHNICAL STAFF VACANCIES:—

(a) ASSISTANT SHIFT CHARGE ENGINEER, Plymouth B Generating Station, N.J.B. G.9, £641-£667.

(b) ASSISTANT SHIFT CHARGE ENGINEER, Newton Abbot Generating Station, N.J.B. F.9, £607-£629.

Superannuation.

Applicants should have had a sound technical training and practical experience in a modern generating station.

Applications, clearly indicating for which generating station, on form A.E.6/ACT, obtainable from the Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed and returned by 30th September, 1954. 5085

SOUTH EAST SCOTLAND ELECTRICITY BOARD

SECOND ASSISTANT ENGINEER (Commercial), Southern Sub-Area Headquarters. N.J.B. G.7 (£729/£758 p.a.). Candidates (preferably qualified to H.N.C. standard) should be able to advise industrial and commercial consumers and have sound knowledge of tariff principles. Knowledge of street lighting and space heating will be an advantage.

Applications, stating age, qualifications and experience, should reach the Board at High Street, Galashiels, within 14 days. 5086

TRANSFORMER DESIGNER

required by well-established transformer manufacturers in North West London area. Experience in all types of transformers up to 20 kVA essential.

Permanent progressive position, pensions scheme and life assurance. Write stating age, experience and salary required.—Box 5006.

A LARGE industrial undertaking in the North-Western area, with world-wide associations, invites applications from honours graduates in electrical engineering who have completed full-time National Service obligations to fill a vacancy in a central technical department. The upper age limit for the post is 28. Previous industrial experience, although desirable, is not essential. The successful candidate will be trained in matters relating to the manufacture, design, development and application of the company's products and will also be given an opportunity of familiarising himself with relevant matters connected with the commercial and sales side of the organisation. The initial training and subsequent experience will be designed to give the candidate every opportunity of advancement to an executive post. The commencing salary will be within the range £600 to £750 p.a. dependent upon the qualifications and experience of the candidate appointed. A non-contributory pension scheme is operated by the company. Please write, giving full particulars, which will be treated in strictest confidence, to—Box 5064.

A WELL-known firm of electrical component manufacturers require able young man to take charge of small assembly section. Some electrical knowledge and ability to control female staff is essential. Modern factory in Wandsworth (London). Write, giving full details of experience, age and salary required, to—Box 94.

ALKALINE BATTERIES Ltd., of Redditch, are the largest makers in the Empire of alkaline accumulators, miners' lamps and emergency lighting systems, which are in rapidly growing use particularly for export. The company has vacancies in its technical sales and development sections for graduate electrical engineers, not over 30 years of age, or for men nearing the end of their degree course who have completed National Service. The posts are pensionable and offer the prospect of executive rank. Applications with full educational details and experience should be addressed —Commercial Manager, Alkaline Batteries Ltd., Union Street, Redditch. 3936

AN opportunity occurs in progressive manufacturing concern in London area for engineer aged 25/35 with electrical or physicist degree, on development and research work on high frequency telecommunication cable and associated testing equipment. Salary will be commensurate with qualifications and experience. Apply, giving full particulars, to—Box 4962.

ASSISTANT buyer with special experience in buying and chasing ferrous and non-ferrous castings, diecastings and steel fabrications. Knowledge of electrical engineering requirements and workshop experience will be considered advantages. Not over 35 years old. Reply in detail to — Chief Personnel Officer, Crompton Parkinson Ltd., Chelmsford. 5098

ASSISTANT chief engineer required by company engaged in the design and development of guided weapons. Candidates must be mechanical engineers with first-class qualifications and experience in electronics and light engineering. Knowledge and experience in servo-mechanisms essential since duties would include responsibility for missile control systems, electrical gyros, accelerometers, etc. Applicants should be 30-35 years of age and have sufficient personality and experience to administer and organise the development activity on these subjects. Write in detail, quoting reference G, to—Box AC.91032, Samson Clarks, 57/61, Mortimer Street, London, W.1. 123

ASSISTANT electrical engineer required by London consulting engineers for preparation of drawings and specifications for electrical installations in all types of buildings. Write giving full details of experience, age and salary required to—Box ER586, L.P.E., 55, St. Martin's Lane, London, W.C.2. 5065

CONSULTING engineers require electrical designer-draughtsman, age twenty-four to thirty-five. Experienced in all classes of lighting and power installations for hospitals, schools, industrial projects; preparation of contract and specifications, etc.; good draughtsmanship essential. Reply to—A. F. Myers & Partners, 147, Victoria Street, London, S.W.1. 5046

CONSULTING engineers require senior and junior electrical engineers with experience of design, specification and supervision of electrical installations for all types of buildings. Apply in writing stating age, experience and salary required, to—Oscar Faber & Partners, 29, Queen Anne Street, London, W.1. 5125

CONTRACTS engineers required for handling of switchgear tenders and contracts. Applications should state age, experience, qualifications and salary required and should be addressed to—Personnel Manager, South Wales Switchgear Ltd., Blackwood, Mon. 4965

CROMPTON PARKINSON Limited invite applications from graduate physicists or electrical engineers with good honours degrees to work in their lamp works development laboratory on general lamp problems. Applicants with or without experience will be considered. Good prospects to a man wishing to make a career in industry. Superannuation scheme to which company contributes. Send full particulars of education and any practical experience to—Ref. LLD, Crompton Parkinson Limited, Guiseley, Nr. Leeds. 4627

DESIGN draughtsman. A vacancy exists in our design drawing office for a first-class designer draughtsman for interesting work associated with the development of automobile electrical equipment. He should be at least of H.N.C. standard and experience in the design of light electrical equipment for large quantity production would be an advantage. The post provides excellent scope for initiative and advancement. Reply, stating qualifications, experience and age, to—Personnel Manager, Joseph Lucas Ltd., Great King Street, Birmingham, quoting reference PM/D/93. 143

DESIGN draughtsman required, preferably aged 25-35, for work on light electrical mechanisms or instruments. H.N.C. preferred. Pension scheme, canteen. Write in tabulated form to—Personnel Manager, Dowty Equipment Ltd., Arle Court, Cheltenham. 4825

DESIGN engineer required by consulting engineers for preparation of electric light and power schemes and specifications for all types of buildings. Previous experience essential. Write, stating age, experience and salary required, to—E. Wingfield-Bowles & Partners, 32, Old Queen Street, Westminster, London, S.W.1. 4970

DESIGNER draughtsman, preferably with experience on electro-mechanical instruments and components. H.N.C. (Mech.) standard with workshop training desirable. Good prospects and conditions. Full particulars of age, experience and salary required to—Muirhead & Co. Ltd., Elmers End, Beckenham. 5126

DESIGNER required for work on medium and high-voltage power factor correction and furnace capacitors. Must have degree or H.N.C. or the equivalent in electrical engineering, and experience in the design and manufacture of medium/heavy electrical equipment. Good prospects. Write, giving full details of qualifications, age and salary required, to—The Technical Director, A. H. Hunt (Capacitors) Ltd., Bendon Valley, London, S.W.18. 71

DRAUGHTSMAN (electrical) required by West London firm for the layout of power and lighting installations and illumination schemes. Applicants should possess O.N.C. or equivalent and have served a recognised apprenticeship. Apply stating age, experience and salary required to—Box 4844.

DRAUGHTSMAN required at the Rugby works of the British Thomson-Houston Co. Ltd. for layout and detailing of A.C. and D.C. motors and generators. Experience not essential. Progressive position for man of ability. Apply to—Chief Draughtsman, Motor Drawing Office, The British Thomson-Houston Co. Ltd., Rugby. 5048

DRAUGHTSMAN required by consulting engineers for the reproduction of electric light and power schemes. Previous experience essential. Write, stating age, experience and salary required, to—E. Wingfield-Bowles and Partners, 32, Old Queen Street, Westminster, London, S.W.1. 4969

DRAUGHTSMAN required, capable of designing, with minimum of supervision, electrical engineering installations for all types of buildings. 5-day week. Salary dependent upon age and experience. Apply, with details, to—J. Stinton Jones and Partners, Consulting Engineers, 21, Gloucester Place, London, W.1. 5035

DRAUGHTSMAN required for design and detail work on electrical/mechanical apparatus. Should be at least of H.N.C. standard. Workshop experience essential. Apply in writing to — Personnel Manager, A. H. Hunt (Capacitors) Ltd., Bendon Valley, Garratt Lane, London, S.W.18. 41

DRAUGHTSMAN required for detail work on specifications necessary for manufacture of paper capacitors. Write or call—A. H. Hunt (Capacitors) Limited, Bendon Valley, Garratt La., Wandsworth, London, S.W.18. 95

DRAUGHTSMEN. Several senior men required for consulting engineers' office. Work entails generating station plant layout and design, including steam, water, coal and ash and other ancillary services, etc., with general mechanical design as applied thereto. Applicants should have sound mechanical engineering background, preferably up to H.N.C. standard. Previous power station experience an advantage, but consideration will be given to suitable applicants with equivalent experience of mechanical plant layout. Five-day working week and pension scheme in operation. Suitable salaries for right men commensurate with age and experience. Applications should be made in writing, giving full details of age, experience and salaries required, to—Merz & McLellan, Carliol House, Newcastle upon Tyne. 5066

DRAUGHTSMEN, sound experience of detailing light mechanical or electro-mechanical equipment, required in London by a large engineering organisation. Salary above Union rates, excellent conditions, pension scheme, living allowance. Please write, giving full particulars of experience and qualifications, to—Box 4966.

DRAUGHTSMEN required for mechanical design of compressed air components. Some mechanical experience essential. Applications, giving details of experience, age, etc., should be addressed to the Personnel Manager, Metropolitan-Vickers Elec. Co. Ltd., Trafford Park, Manchester, 17. 4913

DRAUGHTSMEN, senior and junior, required, with experience of power transformers. Experience on on-load voltage regulators an advantage. Good salary, rates above the N.E.S.D. minimum, contributory pension scheme. Apply stating age, experience and salary required to—Brentford Transformers Ltd. Kidbrooke Park Rd., London S.E.3. 5047

DRAUGHTSMEN, sound experience of switchgear, required by consulting engineers for work in Manchester and Chester. Good salary, pension scheme, living allowance. Please write, giving full particulars of experience and qualifications, to—Box 4967.

DRAUGHTSMEN, sound knowledge of electrical engineering, required by consulting engineers for permanent positions in their Bath offices. Good salary, excellent conditions, pension scheme. Please write, giving full particulars of experience and qualifications, to—Box 4968.

ELECTRIC lighting fittings manufacturers (London, old-established) have vacancy for representative. Connection essential. Commencing short period on commission.—Box 5049

ELECTRICAL circuit draughtsman for manufacturer of automatic temperature controls. Permanent pensionable post for man up to 50 years old. Written applications to—DHS The Rheostatic Company Limited, Slough, Bucks. 4948

ELECTRICAL contractor (London) has vacancy for estimator used to large contracts, capable of handling them from enquiry to completion. Exceptional opportunity for experienced man able to accept responsibility. Applications will be treated confidentially. State age, salary, with concise particulars of experience.—Box 5018.

ELECTRICAL designer/draughtsman required with experience in the design of electrical control panels and control circuits for automatic machinery. Good opportunity, good prospects and interesting work for the right man. Pension fund scheme facilities. Staff canteen, 5-day week. Please apply, stating age and experience to—Projectile & Engineering Co. Ltd., Acre St., Battersea, London, S.W.8. 5051

ELECTRICAL draughtsman required, 21/26 years, for the electrical division of the engineering department of medium/heavy engineering industry. Should have experience in preparation of drawings for electrical installation work and circuit diagrams. Applications to Personnel Manager, Ruston-Bucyrus Ltd., Excavator Works, Lincoln. 5017

ELECTRICAL engineer required, age 25 to 35, capable of designing and supervising electrical engineering installations for all types of buildings. Apply, with details of experience and salary required, to—J. Stinton Jones and Partners, Consulting Engineers, 21, Gloucester Place, London, W.1. 5036

ELECTRICAL engineer required (aged 30-40, preferably chartered), to assume leading position, commanding equivalent £1,000 p.a. to start, in design office of London company. Applicants must be fully conversant with low and medium voltage automatic contactor gear, motors, relay systems, and methods of temperature control. Previous D.O. experience and a thorough knowledge of wiring systems applied to precision machinery is essential. Write in first instance — Personnel Manager, Molins Machine Co. Ltd., Evelyn Street, London, S.E.8. 4892

ELECTRICAL engineer required as chief of power department of large South Manchester company. Responsibilities include control of designing, estimating and contracting for power and control equipment of wide range of mechanical plants. University degree desirable. Good background of technical and practical experience essential. Preference given for proved managerial capabilities. Applications will be kept strictly confidential and should give full details of age, qualifications, experience and salary required to ref. EQ80.—Box 5068.

ELECTRICIAN fitter wanted by East London firm. Man with tools and initiative. Able to work without supervision on plant maintenance and repairs. North Country training an advantage.—Box 4947.

ELECTRICAL engineer required by Messrs. Norman & Dawbarn, Architects and Consulting Engineers, 5, Gower Street, London, W.C.1. Graduate or Corporate Member of the Institution of Electrical Engineers with experience of industrial and domestic types of installation preferred. The work will involve the preparation of drawings, specifications and contract documents, with some supervision of contract works. Write, stating age, qualifications, experience and salary required. 5037

ELECTRICAL fitter and wireman, experienced on power boards and telecommunications contracts. State experience and wages required.—Troughton & Young (Manufacturers) Ltd., 18, Beddington Farm Road, Purley Way, Croydon (Tel. Croydon 6892). 5050

ELECTRICAL fitters are required by the British Electricity Authority at their Nottingham Transmission Section. The nature of the work involved includes the overhaul of 132,000-volt transformers and switchgear at transforming stations within the Nottingham section. Previous experience of H.V. apparatus would be an advantage. Rate of pay 45.00d. per hour, 44-hour week. Terms and conditions of service in accordance with N.J.I.C. agreement. Applications in writing, to Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham. Please quote Vacancy No. 109/54/ER. 5121

ELECTRICAL (machine-tool) engineer conversant with the latest machine-tool practice is required for electrical development work, the preparation of specifications, wiring diagrams, etc., in a progressive West Midland factory. Applicants should possess an H.N.C. or equivalent qualification and have initiative and drive. Salary £700/£800 p.a.; age 26/35; pension scheme. Please apply, giving full details of training and experience, to—Box 2J J. 7453, A.K. Advg., 212a, Shaftesbury Ave., London, W.C.2. 5106

ELECTRICAL wholesalers require storesman. Previous experience desirable. Permanent position. — London Electrical Co., 92, Blackfriars Road, London, S.E.1. 5038

ELECTRICIAN capable of handling A.C. or D.C. plant required for maintenance and new work. The post is permanent and pensionable. Age up to 45 years. Apply in writing stating age, details of experience and with whom apprenticeship was served, to—Messrs. Truman, Hanbury, Buxton & Co. Ltd., 91, Brick Lane, London, E.1. 5090

ELECTRICIAN required by London Electricity Board in Stoke Newington District of Northern Sub-Area. N.J.I.C. rates and conditions. 4s. 1d. p.h. Application forms from Personnel Officer, 46, New Broad Street, E.C.2. Please enclose addressed envelope and quote ref. M/3262/R. 5127

ELECTRICIAN wanted, call.—Brice, 180, Drury Lane, London, W.C.2. 5015

ELECTRICIAN wanted, one used to high-class work, for London contractor. Permanency. Write stating age and experience to —Box 5067.

ELECTRONIC/electrical engineer required to take charge of small laboratory. Applicant must have some years' experience in laboratory of manufacturers or large scale users of any of the following: cables, capacitors or insulation materials. Maximum age 35. London, E.11 area. Write fullest particulars.—Box 4915.

ENGINEER required for an engineering department dealing with the application of heating elements to various industrial and domestic processes. A knowledge of heating elements is not essential as a training period will be given. Applicants must have at least Higher National Certificate in Electrical Engineering and be aged 25-35. Salary according to age, qualifications and experience. Write giving full details to the Personnel Manager, Metropolitan-Vickers Electrical Co. Ltd., Trafford Park, Manchester, 17. Mark envelope "Heating Element." 5128

ESTIMATING (sales) clerk (male) aged 21/30 required. Good standard in maths. and general education essential. Progressive, superannuation, sports. Permanency for right man. Apply—Personnel Officer, Southern United Telephone Cables Ltd., Dagenham Dock. 4963

EXPERIENCED instrument panel wiremen required S.E. London. Good prospects.—Box 7559.

EXPERIENCED senior draughtsmen required by large engineering company in the City. Successful applicants will be paid in accordance with their ability, experience and desire to work. The company would like their draughtsmen to make a career of the drawing office and is willing to pay ample salaries to the right men to ensure they remain in our employ and do a reasonable day's work. No trouble makers need apply. Five-day week, pension scheme. Apply to Box 4829, giving full particulars of age, education and experience.

FERGUSON PAILIN Ltd., Higher Openshaw, Manchester, 11, have vacancies at head office for qualified switchgear engineers with some sales or contracts experience. Good salaries will be paid to competent men having the ability to progress. Duties will involve principally the preparation of tenders and subsequent engineering specifications for substation and power station switchgear. Applications to the Personnel Manager. 4950

FERRANTI Ltd. (Meter Dept.), have a few vacancies in the experimental dept. for men of approximately Graduate status in Electrical Engineering or Physics. A particular interest in the theory of electrical measurements is desirable. The work of the department covers a variety of interesting electrical and electromechanical problems arising in the development of all types of electricity meters. Permanent staff appointments with pension benefits. Application forms from—Mr. T. J. Lunt, Staff Manager, Ferranti Ltd., Hollinwood, Lancs. Please quote reference MDE. 4977

FOREMAN winder to take control of repair shop. Apply — Priory Electric Service (Coventry) Ltd., 3, Lower Ford Street, Coventry. 4896

HONG KONG merchants and contractors (British) require an assistant, age 24/26, who has completed engineering apprenticeship. Duties initially would be electrical engineering sales. Good pay and conditions. Write with full details training and experience to — Box R.379, c/o Streets, 110, Old Broad Street, London, E.C.2. 5039

HOUSING assistance will be offered to electrical foreman with wide production experience in radio industry of small and medium electrical contact gear manufacture, test and installation required by manufacturers of materials handling vehicles. Pleasant country district, 1 hour London. Good prospects of advancement; canteen and social facilities. Please write giving details of past experience, present salary, salary required, married/single, to—Box 5069.

INSPECTORS for electrical work required with experience of installations in large buildings or lift practice. Rate of pay 220s. 6d. p.w. Application form from Chief Engineer (54/50), London County Council, County Hall, S.E.1, returnable within next 14 days (enclose S.A.E.) (1212). 5130

JOHNSON & PHILLIPS Ltd., have vacancies in their transformer department for transformer draughtsmen having experience in all sizes up to 1,000 kVA. In addition vacancies exist for men having experience in sizes 1,000 kVA to 30,000 kVA and the higher voltages. Applicants should state age, training and experience, together with salary required, to—Employment Manager, Johnson & Phillips Ltd., Victoria Works, Charlton, London, S.E.7. 4951

JOINTER, plumber cable, first class, required for service overseas (12 months) by large engineering firm. Write, stating age, experience, references.—Box 4897.

JUNIOR electrical engineer, H.N.C. standard, required by consulting engineers. Must be capable draughtsman used to building layout and design of all types and with good knowledge of H.T. and L.T. power distribution.—Box 5070.

JUNIOR engineers required by British Electricity Authority on operating staff of the power stations in North West England, particularly the Manchester, Salford and Wigan areas. Applicants should have completed a recognised form of practical training and have a theoretical attainment of at least Ordinary National Certificate in Electrical or Mechanical Engineering. Fundamental knowledge of electro-technology is essential. Commencing salary in range £402/£545. Good promotion prospects. Pension scheme. Applications to Controller, British Electricity House, 825, Wilmslow Rd., Manchester, 20, quoting Vacancy No. 163/54R. 5089

KEEN young sales engineer required as Midlands representative by manufacturers of all forms industrial M.V. switchboards, cubicles, control panels, substation switchboards, feeder pillars, etc., with full range heavy duty combination fused switches to 800 amps. and full industrial and domestic range of fusegear. Give details of experience in confidence to—Managing Director, Dennis Switchgear, Fleming Road, Speke, Liverpool. 5091

LABORATORY engineer. H.N.C. or equivalent. Experience magnetic amplifiers and control circuits. Housing and pension scheme available. Apply—Personnel Manager, Electro Methods Ltd., Caxton Way, Stevenage, Herts. 5040

LEADING oil company require an electro-mechanical draughtsman for design and detail work on experimental laboratory equipment at their research station near London. Applicants under 30 years of age. Must be in possession of Ordinary National Certificate and if possible should have had 2 years' workshop experience. Salary according to age, qualifications and experience. Pension scheme. Write giving full details, and quoting H.3156, to—Box 6972, c/o 191, Gresham House, London, E.C.2. 5041

MECHANICAL draughtsman wanted for factory in West Midlands. Permanent and pensionable post, attractive working conditions. Maximum salary approximately £730 p.a. Experience of design of malleable castings an advantage. Apply giving particulars of age, qualifications and experience to—Box 5071.

MECHANICAL engineer required by cable works for production machine experimental and development work. Minimum qualification H.N.C. Age limits 30 to 40 years. The prospects are good and this is an opportunity for a man who likes to see the results of his ideas put into practice. Commencing salary according to qualifications and experience. Pension scheme. Apply in confidence, giving particulars in chronological order, to—Works Manager, Southern United Telephone Cables Ltd., Dagenham Dock, Essex. 5056

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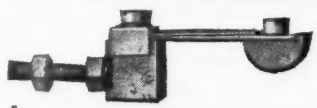

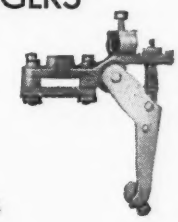

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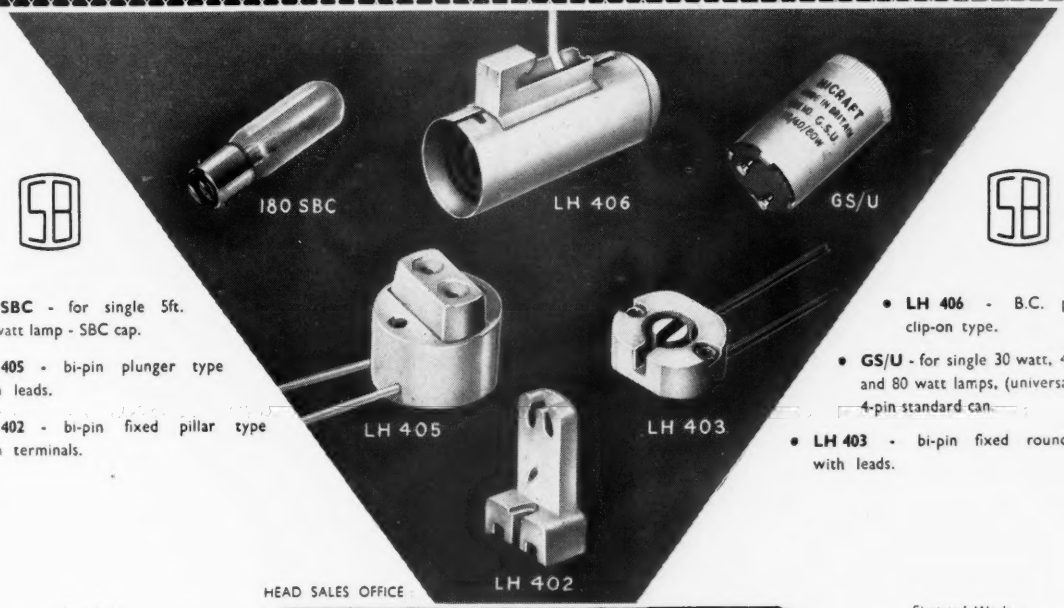

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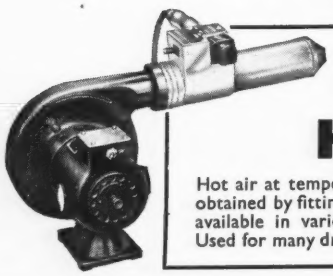

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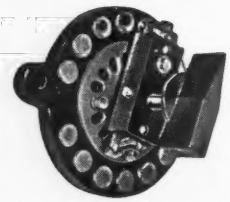

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